

## SERVICE INFORMATION

SINGLE STANDARD COLOUR  
TELEVISION RECEIVERS incorporating  
**Main Chassis Type A823AV**  
**and employing VARACTOR TUNING**

BUSH  
DORIC  
DEFIANT  
EIRE  
GRANADA  
MURPHY

Supplement to Single Standard Colour Television Manual TP1741

### General Information

The range of receivers covered by this Service Information incorporate main chassis type A823AV and varicap tuner units in place of the mechanical tuners fitted to the earlier range of single standard colour receivers. These receivers are basically similar to the earlier range but use the Z582 I.F. and Sound Output panel instead of the A809 or Z182 panels; and the Z584 Decoder instead of the A807 or Z180 panels. Information noting the differences between the Z582 and the Z182, and between the Z584 and the Z180 are given below.

The principal information contained in this publication concerns the varicap tuner and a.f.c. panel type Z513 (incorporating a.f.c. panel type Z512 and u.h.f. tuner type Z511). This standard unit covers the u.h.f. bands 4 and 5, but if required, these receivers may be converted for operation on v.h.f. bands 1 and 3 by fitting conversion kit type Z564 (which includes unit type Z570, which in turn incorporates a.f.c. panel Z512 and v.h.f. tuner type Z565). The v.h.f. unit type Z565 is manufactured by Mullard Ltd: no detailed information on this unit is included in this publication.

### Contents

	Page No.
Title	1
Printed Panel Variants . . . . .	1
Circuit Description . . . . .	2
Alignment Procedure, Z513 . . . . .	2
Adjustment Procedure, Z584 . . . . .	3
Parts Lists—Electrical . . . . .	6
Mechanical . . . . .	7

### PRINTED PANEL VARIANTS

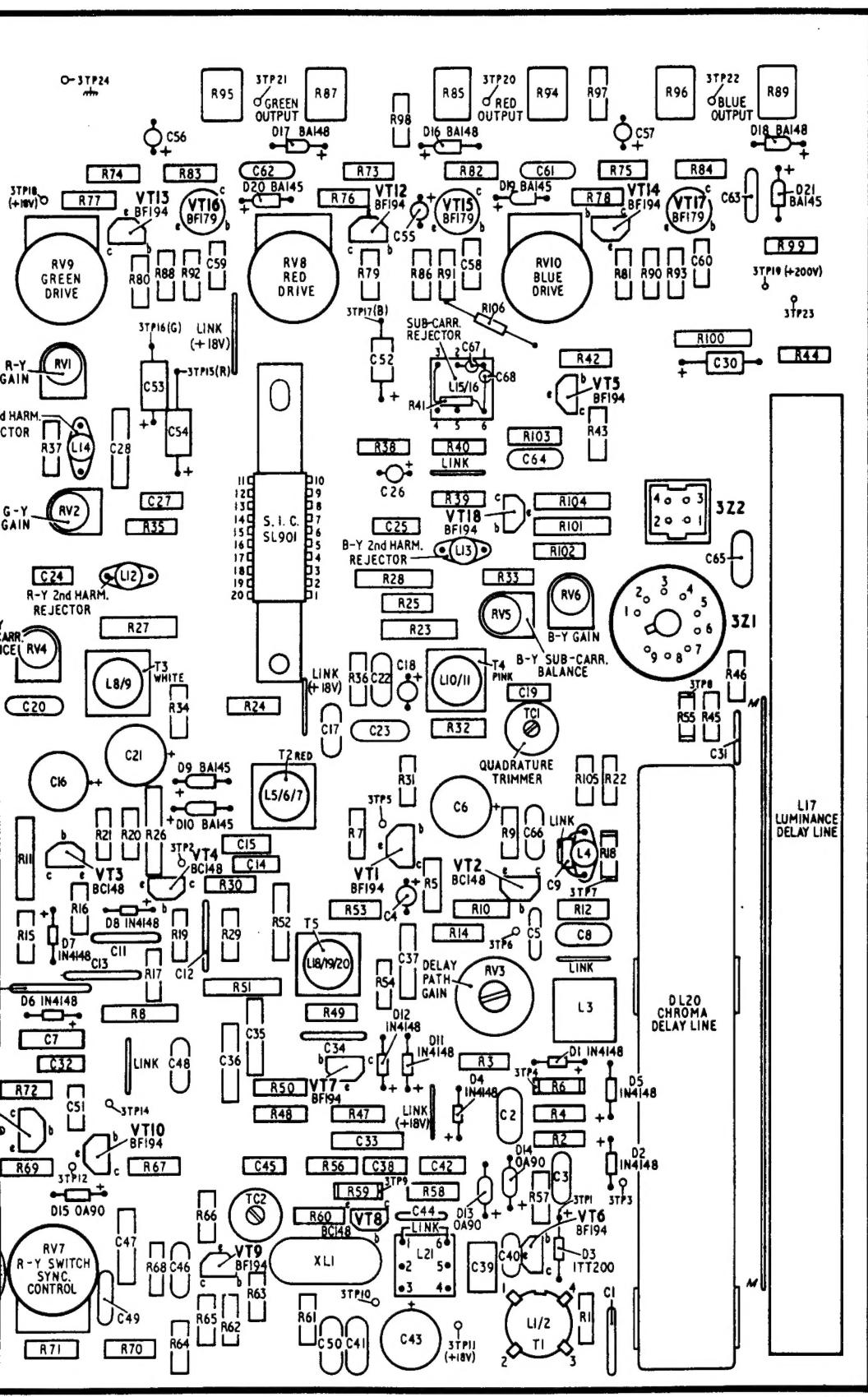
#### I.F. and Sound Output Panel, Type Z582.

This panel is identical to panel, type Z182 apart from the inclusion of a pre-set Colour control mounted on the panel adjacent to the plug 2Z3. This pre-set control replaces the function served by the Customer Colour control on the Z182 panel. Also as part of this change resistor 2R35, 18kΩ, is moved to holes adjacent to, and in series with the pre-set control.

#### Decoder and R.G.B. Drive Panel, Type Z584.

This panel is a development of the decoder type Z180. The Z584 incorporates provision for con-

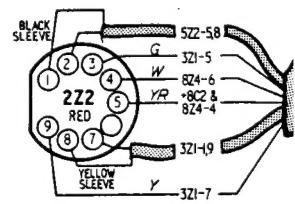
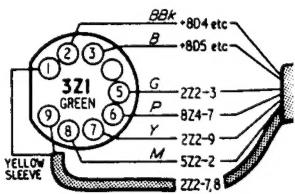
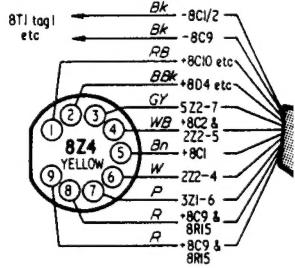
trolling picture saturation at high level instead of the low level control of the chrominance amplifier employed on the Z182 i.f. panel. This development involves the replacement of the LK1 on the Z180 panel with a 0.1μF capacitor, 3C65 Part Number 2601 0070 and the connection of the Customer Colour control, to two of the test point pins, 3TP27 and 3TP25, these pins becoming plugs 3Z11 and 3Z6 respectively. The Customer Colour control now operates at high level and controls the gain of the chrominance channel within the SL917A s.i.c. This change has necessitated amendments to be made to the decoder Adjustment Procedure, see Page 3.



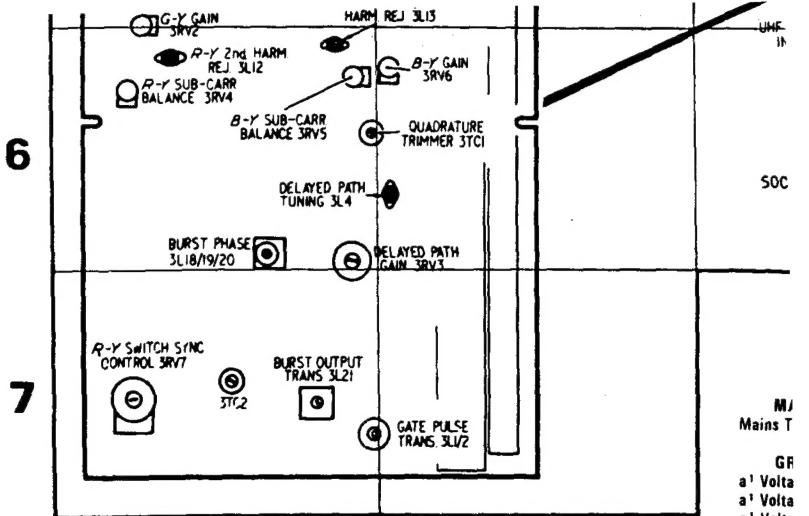
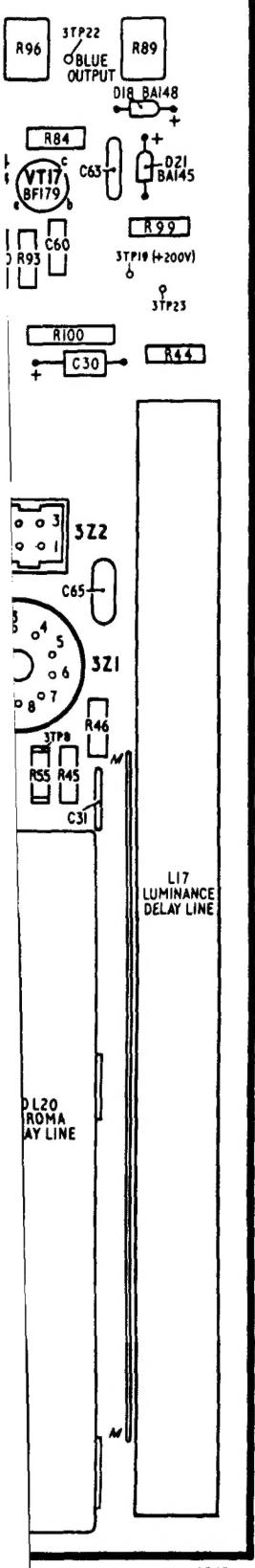
5547

### R.G.B. DRIVE PANEL Type A807

### CAPACITOR PLATE



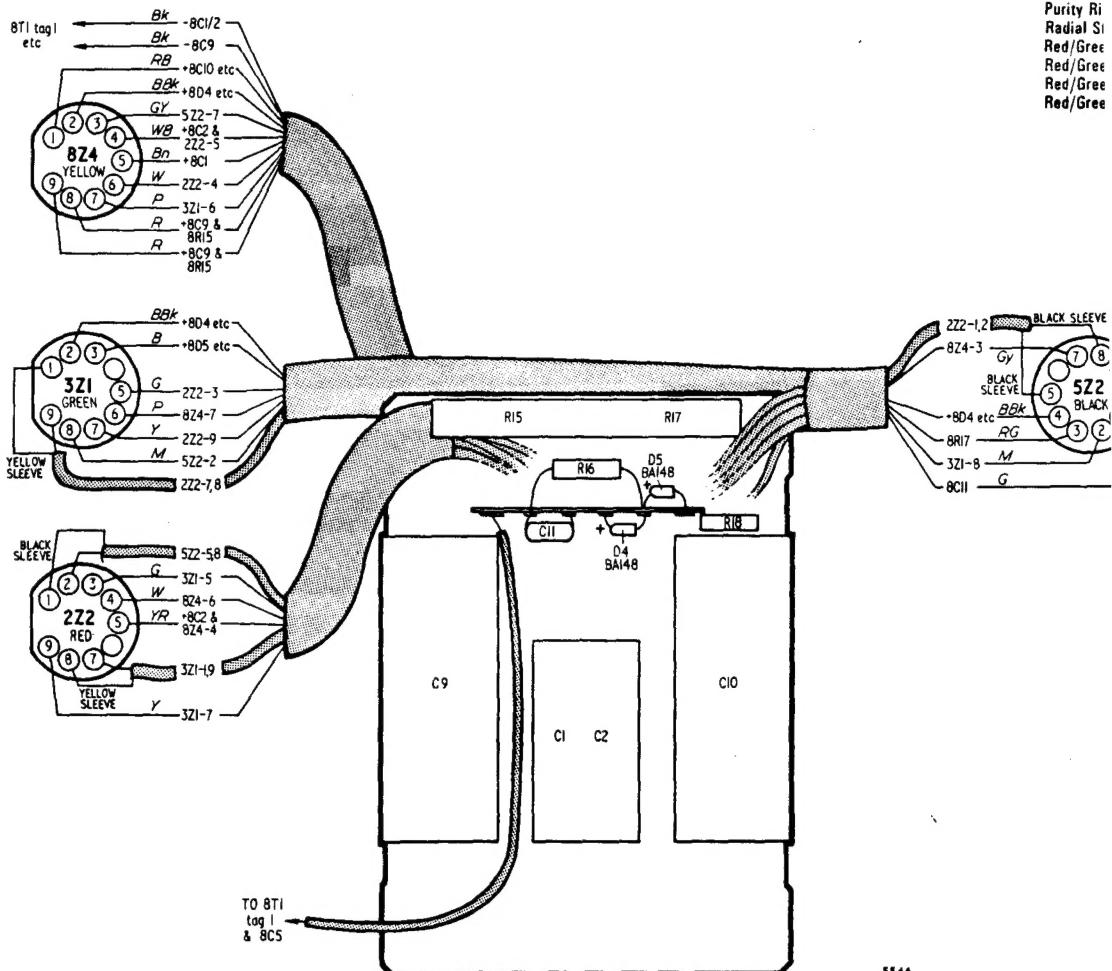
TO 8T1  
tag 1  
& BC5



MJ  
Mains T

GF  
a<sup>1</sup> Volta  
a<sup>1</sup> Volta  
a<sup>1</sup> Volta  
Blue Ori  
Green Ori  
Red Driv  
Gun Swi

CON  
Blue Hor  
Blue Hor  
Blue Hor  
Blue Lat  
Blue Lat  
Blue Ver  
Blue Ver  
Horizont  
Purity Ri  
Radial Si  
Red/Gree  
Red/Gree  
Red/Gree  
Red/Gree



5546

## CAPACITOR PLATE & CABLEFORM

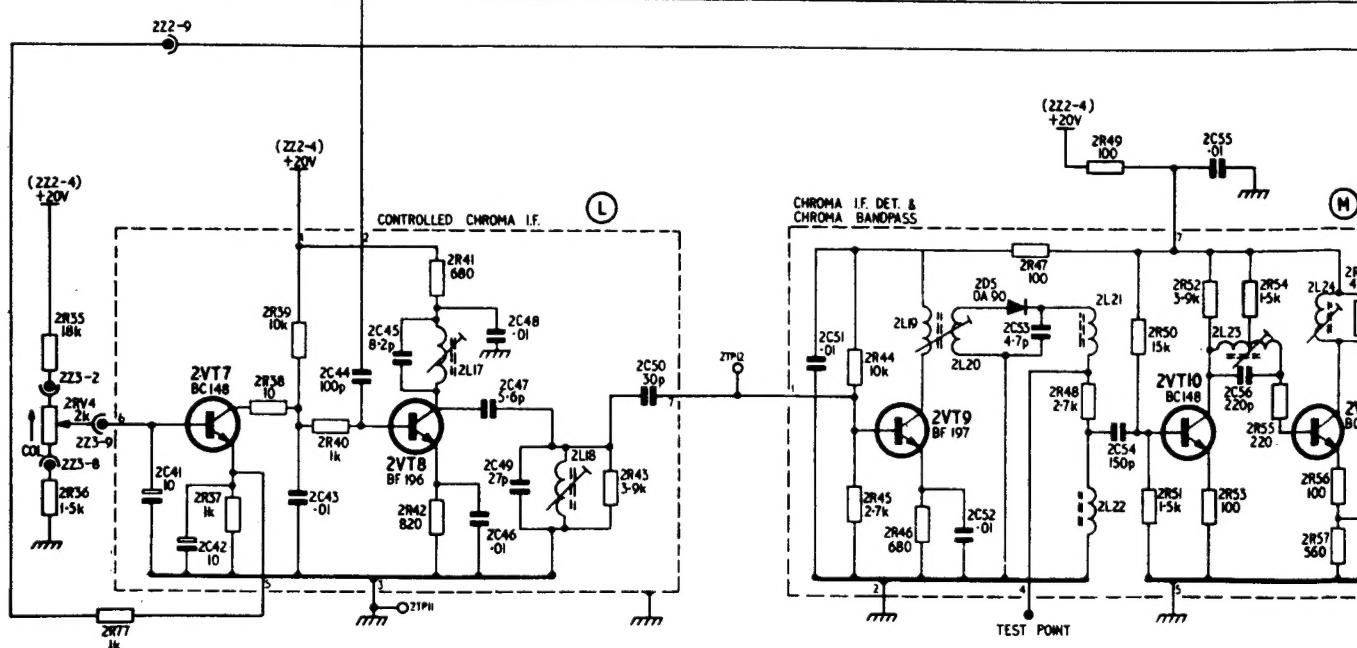
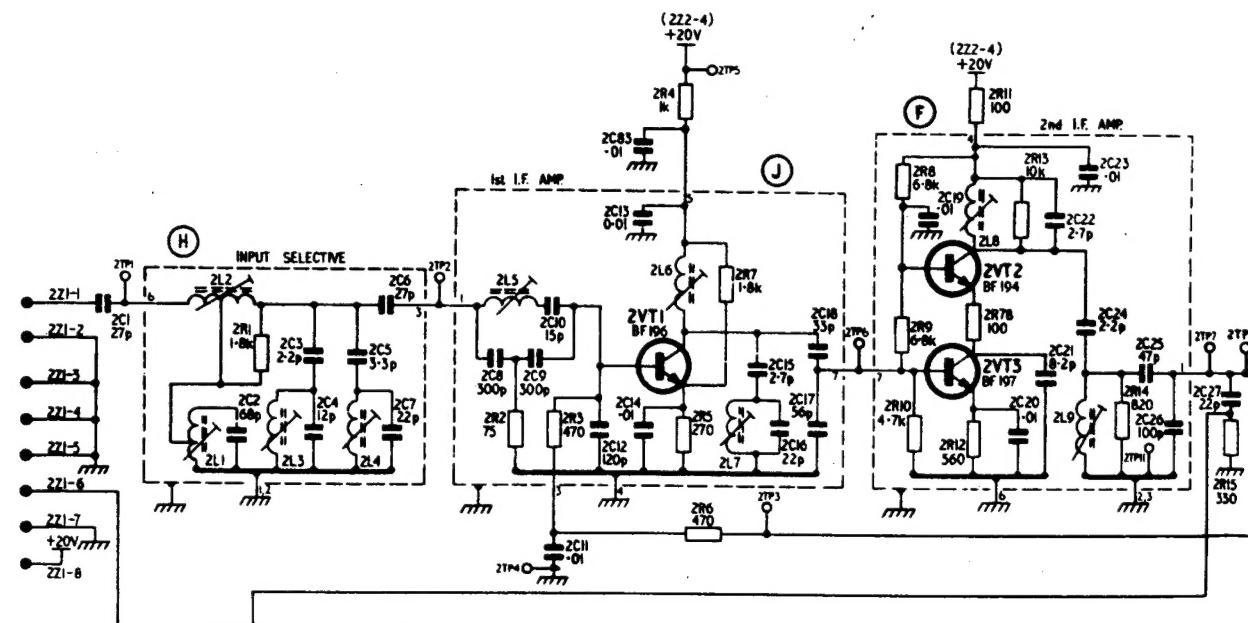
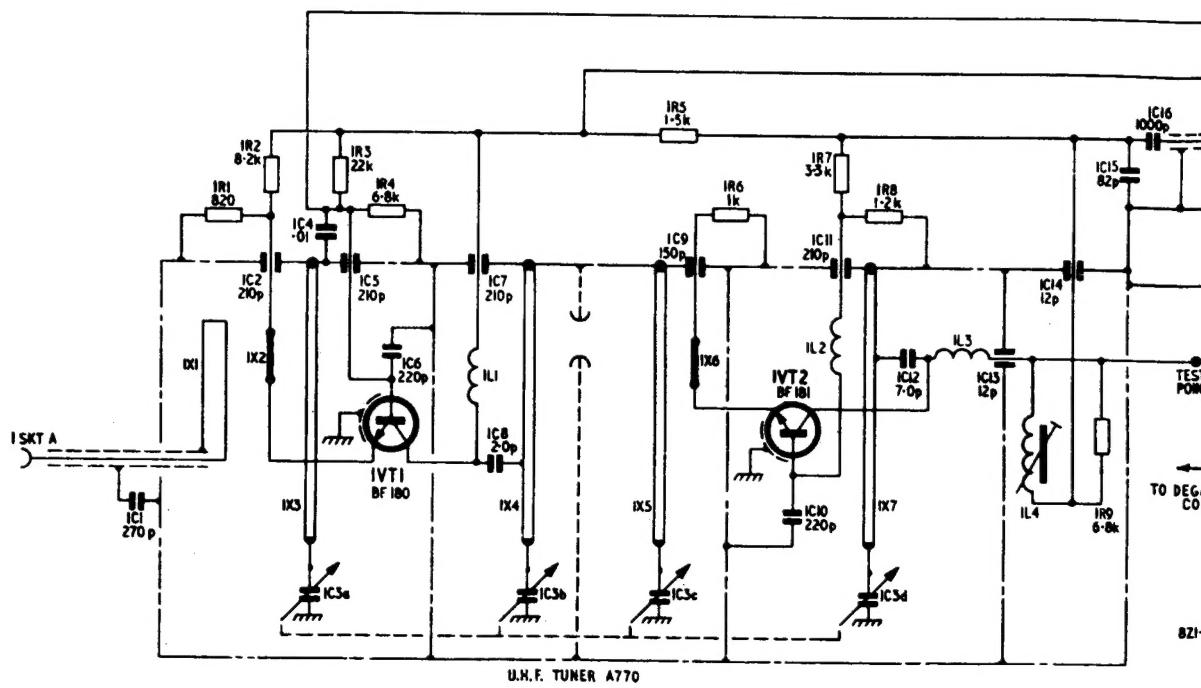
VT13 65 66

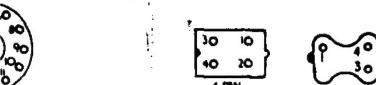
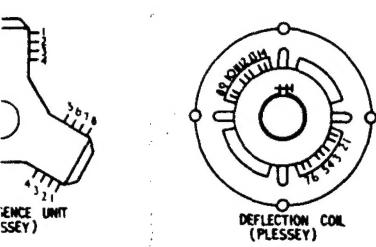
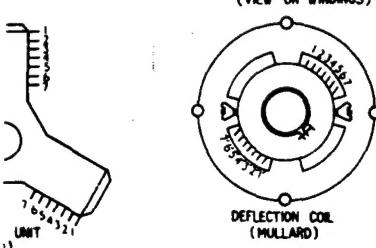
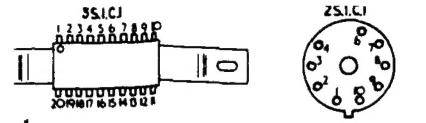
81

R65 R69 R67

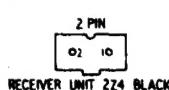
VT13 R74 R76 R75 (+ CBI)

R2-2





No. COLOUR UNIT PLUG No. COLOUR  
Z2 WHITE RECEIVER 322 WHITE TUBE BASE 421  
Z1 WHITE



INDICATES CLOCKWISE  
ROTATION OF  
VARIABLE RESISTORS

LUMS & TRANSISTORS  
N PINS  
WED ON WINDINGS

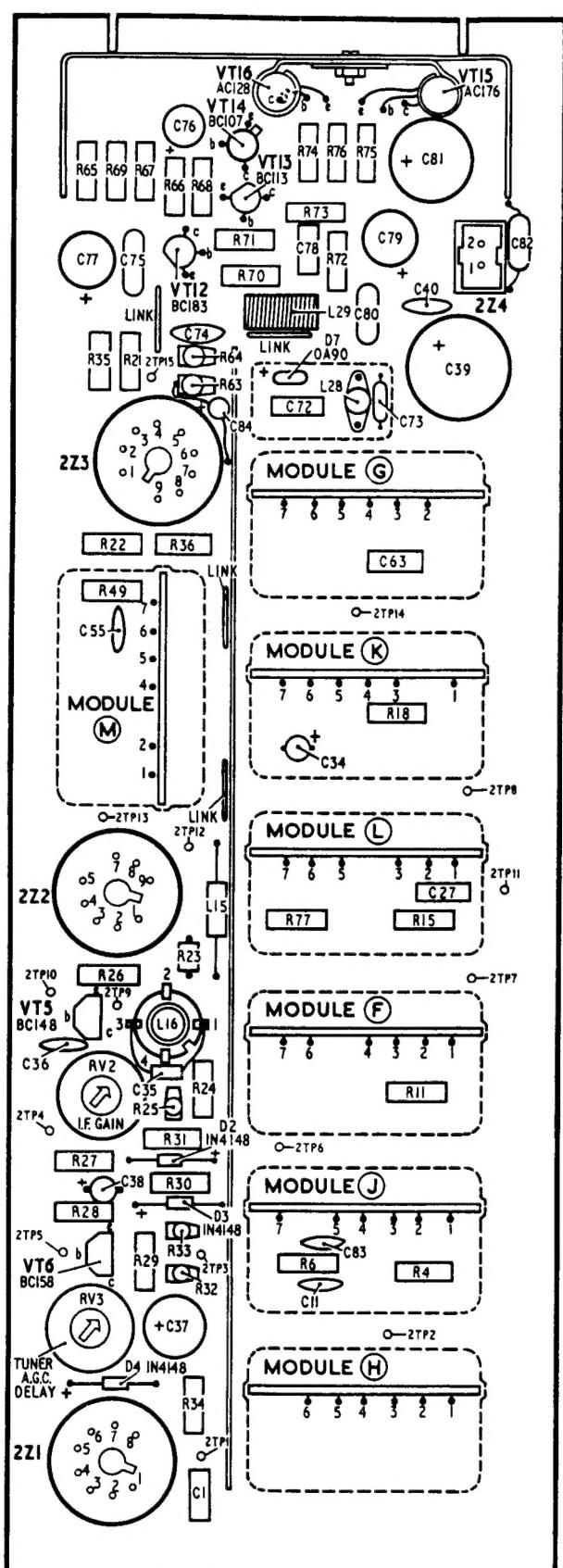
RESISTOR VALUES IN OHMS  
CAPACITOR VALUES IN  $\mu$ F  
UNLESS OTHERWISE STATED

Ref.	Type	Electrode Voltage			Remarks
		emitter	base	collector	
4VT1	BC117	-76.0	-74.0	2.0	
4VT2	BC171	-85.0	-78.0	-75.0	
5VT1	BC170B	0	0	9.0	
5VT2	BSY84	0.1	0	3.1	
5VT3	BC108	0	0	17.4	
5VT4	BC170B	2.6	3.1	17.5	
5VT6	BC147	5.8	6.0	16.0	
5VT7	BD131	0	0.4	20.0	
5VT8					
5VT9	BC148	0	0	1.2	
5VT10	AC128	1.5	1.3	0	
5VT11	BD131	21.5	22.0	35.0	
5VT12	BD131	0.75	1.4	22.0	
6VT1	BU105	N.T.	N.T.	N.T.	
6VT2	BU105	N.T.	N.T.	N.T.	
7VT1	AC128	—	—	—	Connected as diode
7VT2	AC128	—	—	—	Connected as diode
5THY1	BRY39	Cathode	C. Gate	Anode	A. Gate
Ref.	Pin No.	Electrode		Voltage	
4V1	1	Heater		6.3V a.c.	
	2	Cath., Red		130	
	3	Grid, Red			
	4	A <sup>1</sup> , Red			
	5	A <sup>1</sup> , Green			
	6	Cath., Green		130	
	7	Grid, Green			
	8	No. Pin			
	9	A <sup>2</sup> , Focus		5-8kV	
	10	No. Pin			
	11	Cath., Blue		130	
	12	Grid, Blue			
	13	A <sup>1</sup> , Blue			
	14	Heater			Chassis

## CIRCUITS DIAGRAM

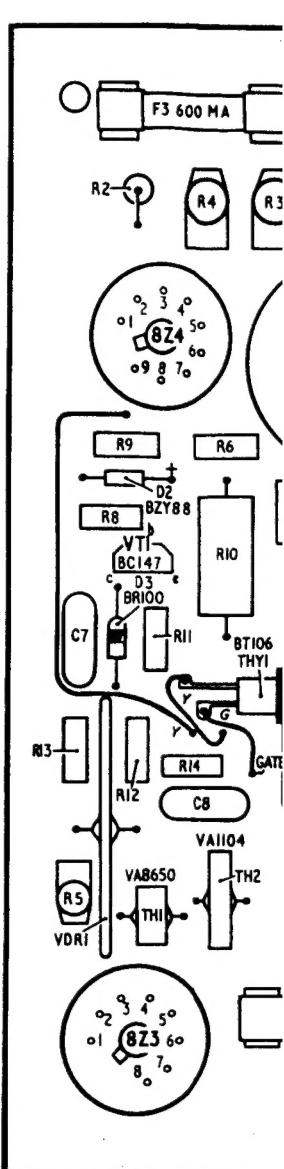
# I.F. & SOUND OUTPUT PANEL Type A809

MISC.	R	C
VT15		
VT14	74 76 75	76
VT13	65 69 66 67 68	81
	73	
Z4	71 72 77 75	79 82
VT12	70	40
L29		80
D7		74
TP15	35 21	64
L28	63	39
	72	
Z3	64 73	73
	22 36	63
TP14	49	55
	18	
TP8		34
TP13		
TP12		
Z2	22 LIS	27
	77 15	
TP10	23	
TP7	26	
TP9		
VT5		
L16		
AV2		36
TP4	24	II 35
D2	25	
TP6	31	
	27	
	30	38
D3	28	
TP5	33	
VT6	29	6
TP3	32	4
RV3		83
TP2		11
O4		37
TPI		34
Z1		1



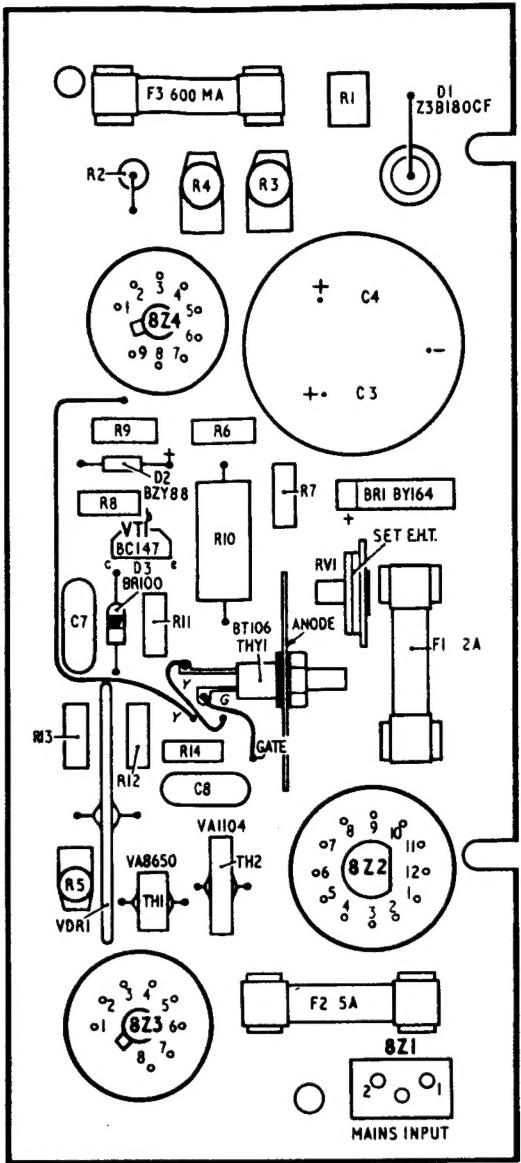
# POWER SUPPLY PANEL T<sub>Y</sub>

MISC.	R	C
F3	D1	I
	2	4 3
Z4		4
	9 6	
D2	BRI	8 7
VT1		10
D3	RVI	
TH1		II 7
	13 14	12 8
TH2	Z2	5
TH1	VDR1	
	F2	Z1

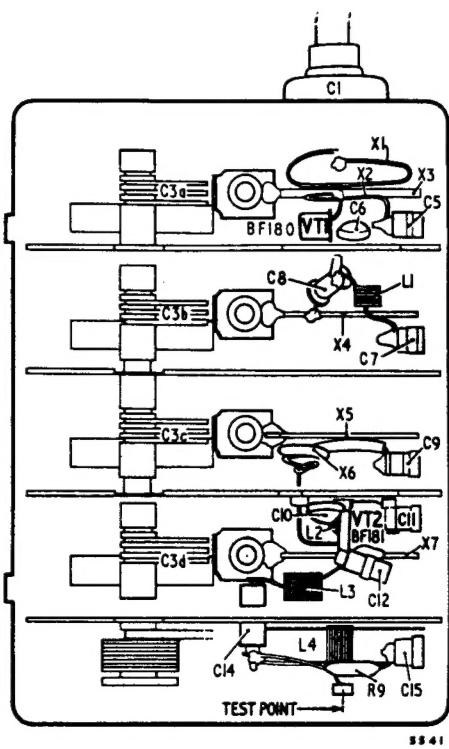


# POWER SUPPLY PANEL Type A801

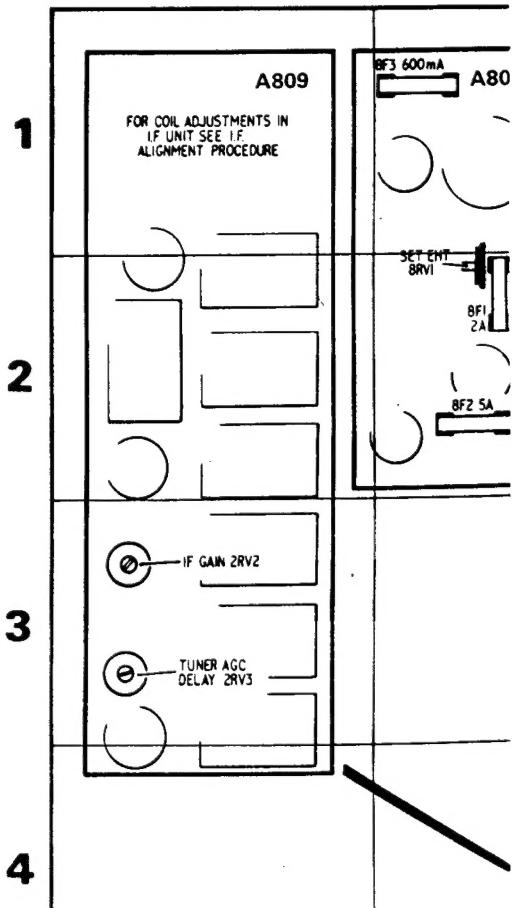
MISC	R	C
F3 D1	1	
	2 4 3	
Z4		4
	3	
9 6		
D2 BRI	7	
VTI	10	
D3 RVI		
THY1	11	7
	13 14	
12		
8		
TH2 Z2	5	
TH1 VDR1		
F2		
Z3		
Z1		



# TUNER UNIT Type A770

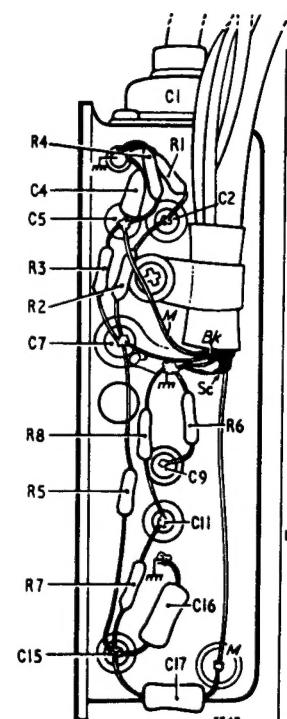
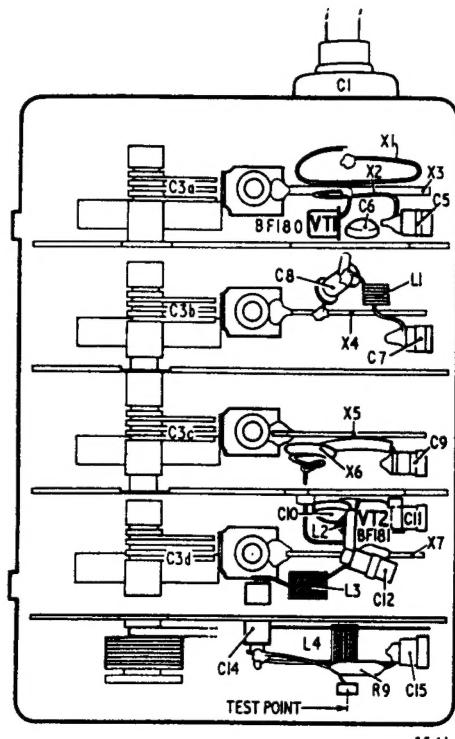


A

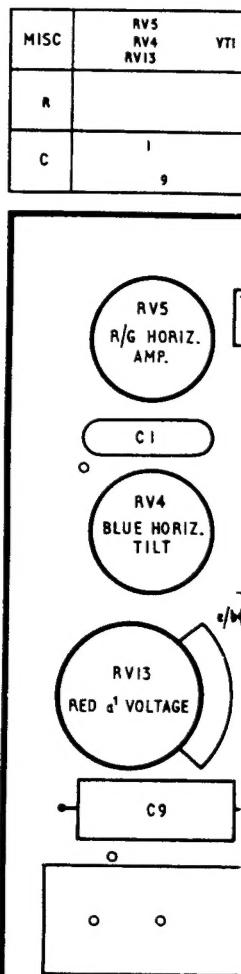


# TUNER UNIT Type A770

CONVERGEN



MISC.	C	R
X1 X2 X3	1	4 1
VTI	4 2	6 5
LI	3	3
X4	2	7
R3	3b	3b
R2		
C7		
R8	9	8 6
R5		
X5	3c	5
X6		
VT2	10 11	34
L2 X7		
R7	12 16	7
C15	14 17	9
C16		
C17		

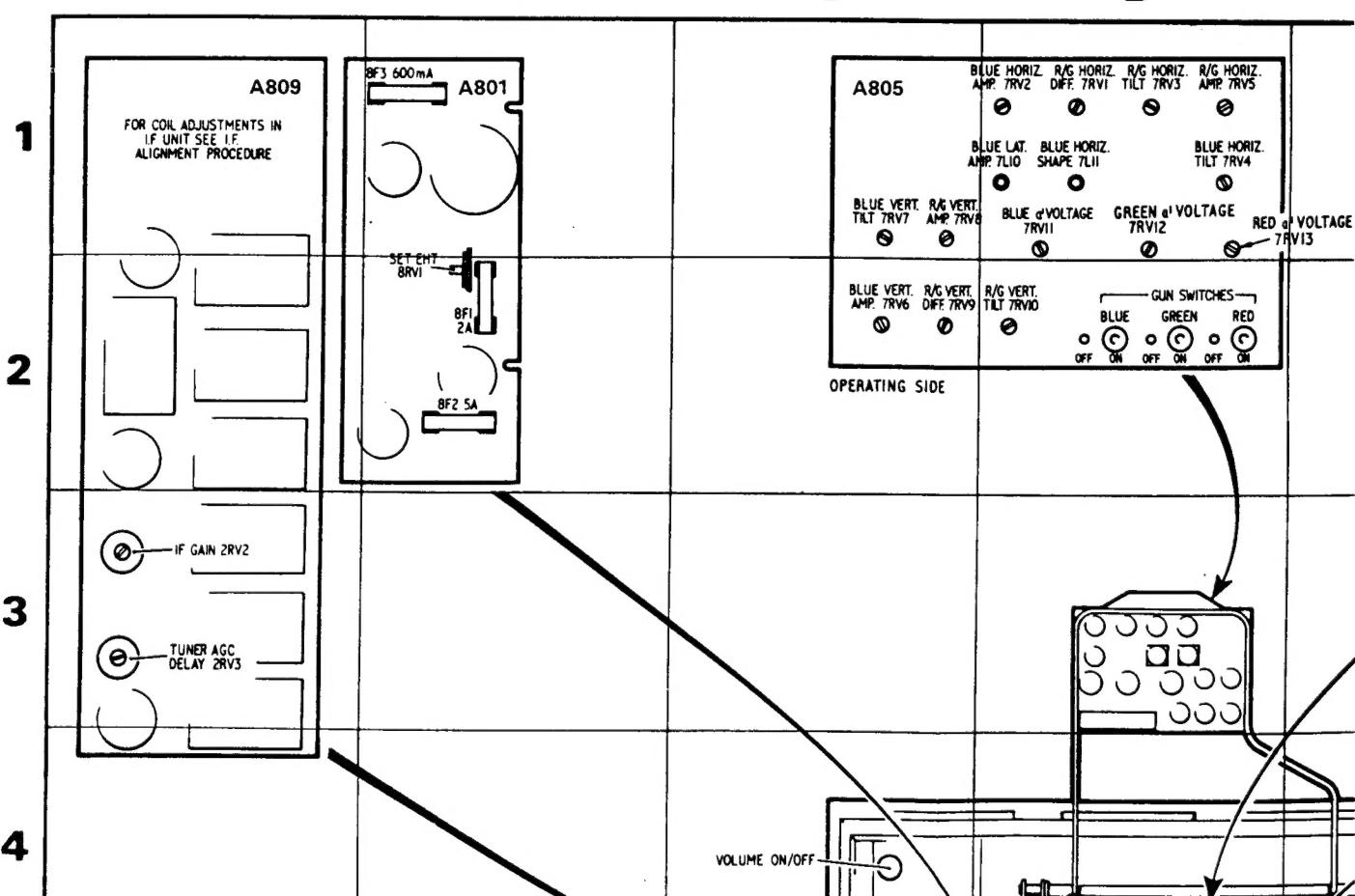


A

B

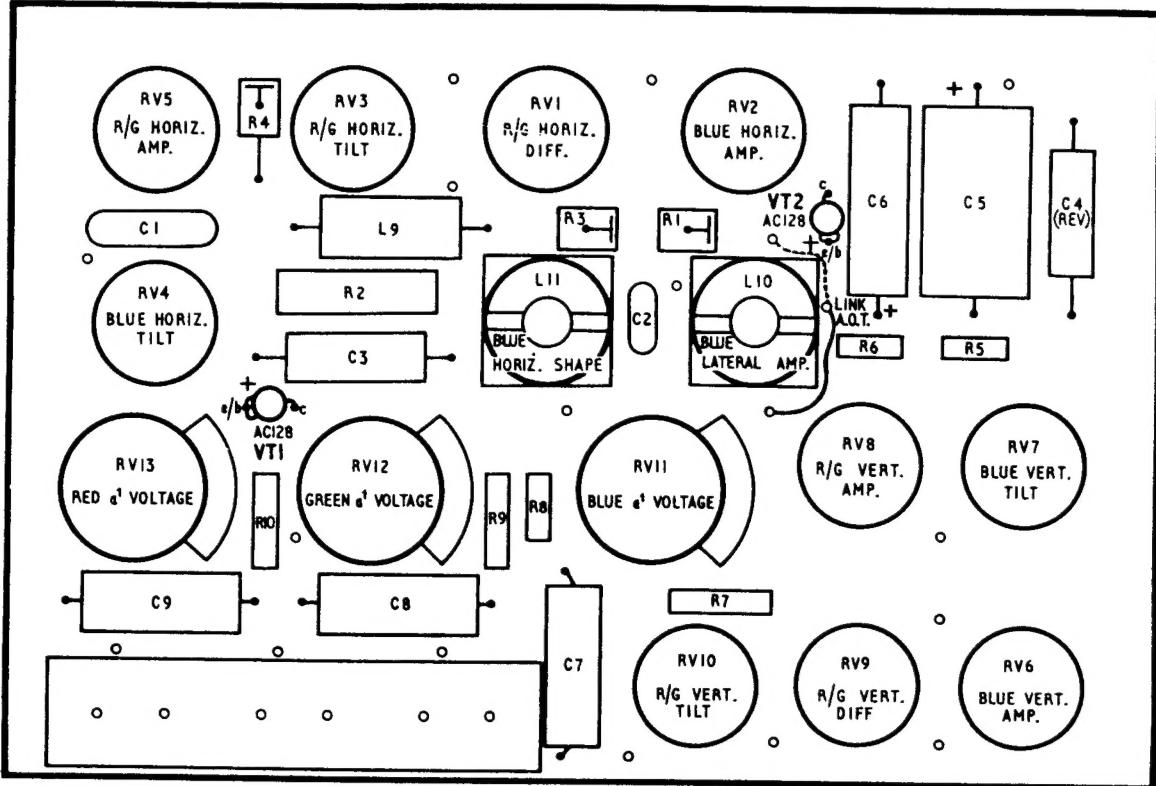
C

D



# CONVERGENCE UNIT Type A805 (Component side)

MISC	RV5 RV4 RV13	VTI	RV3 L9 RV12	RV1 LII	RVII RV10	RV2 L10	VT2	RV8 RV9	RV7 AV6
R			4 10	2 9 8	3 1 7	1 7	6	5	
C		1	3 8	7 2			6	5	4



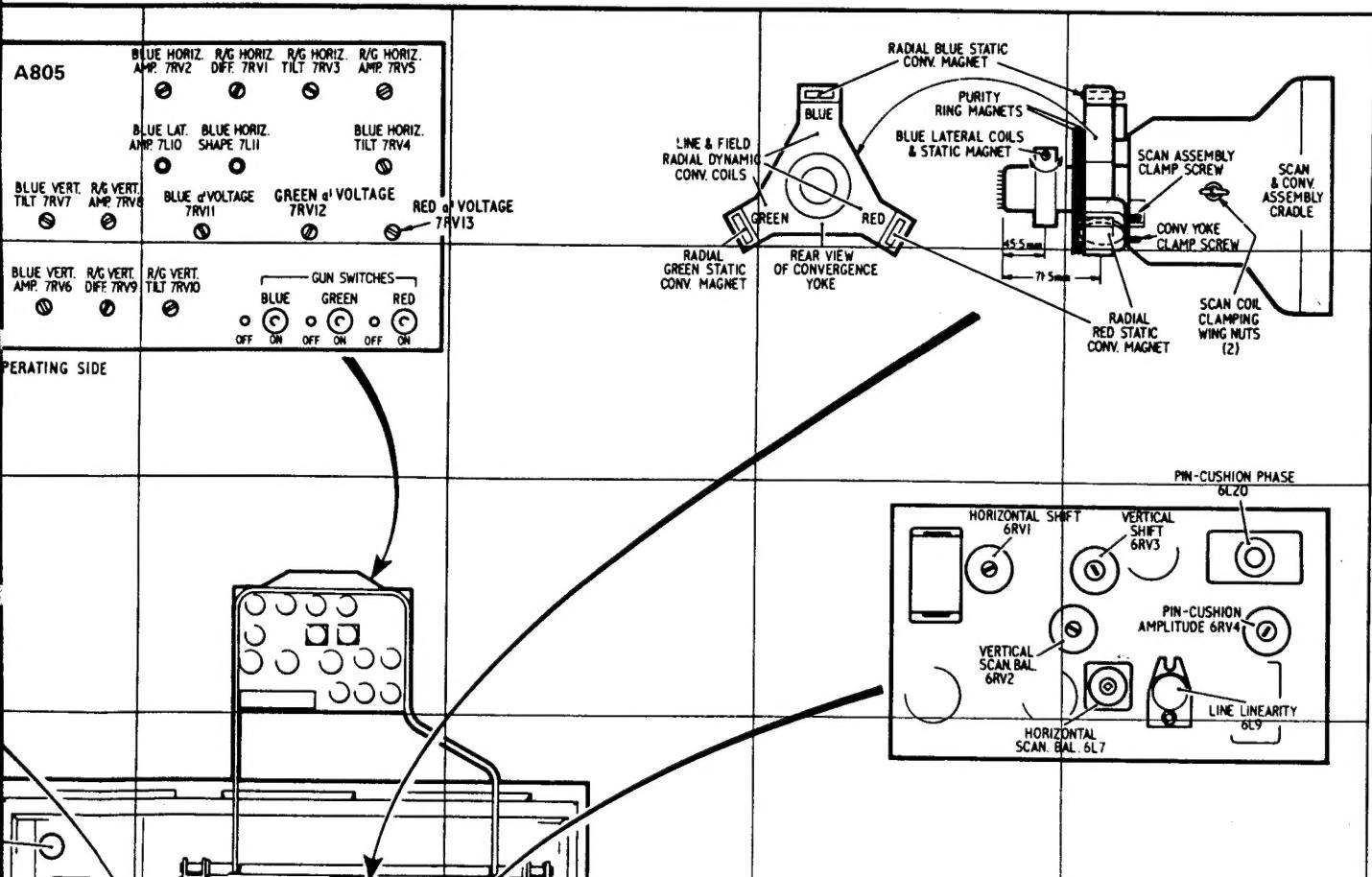
5558

D

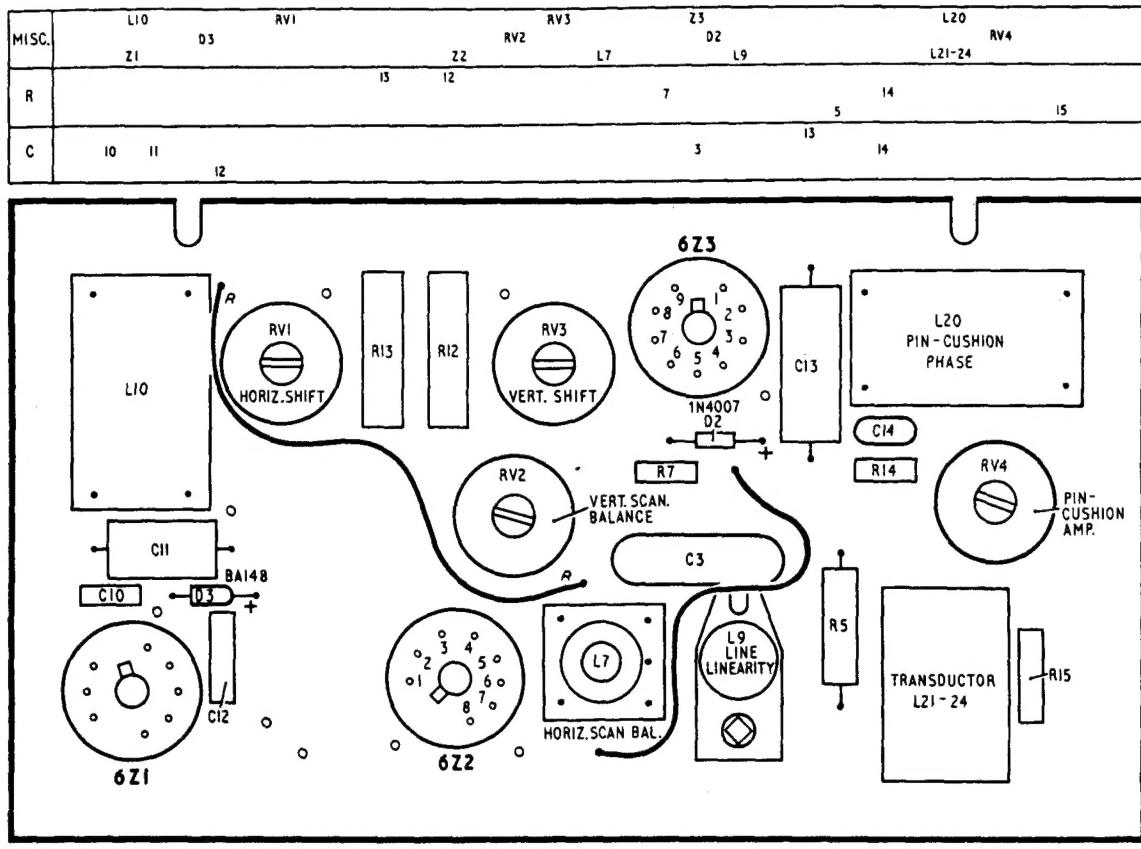
E

F

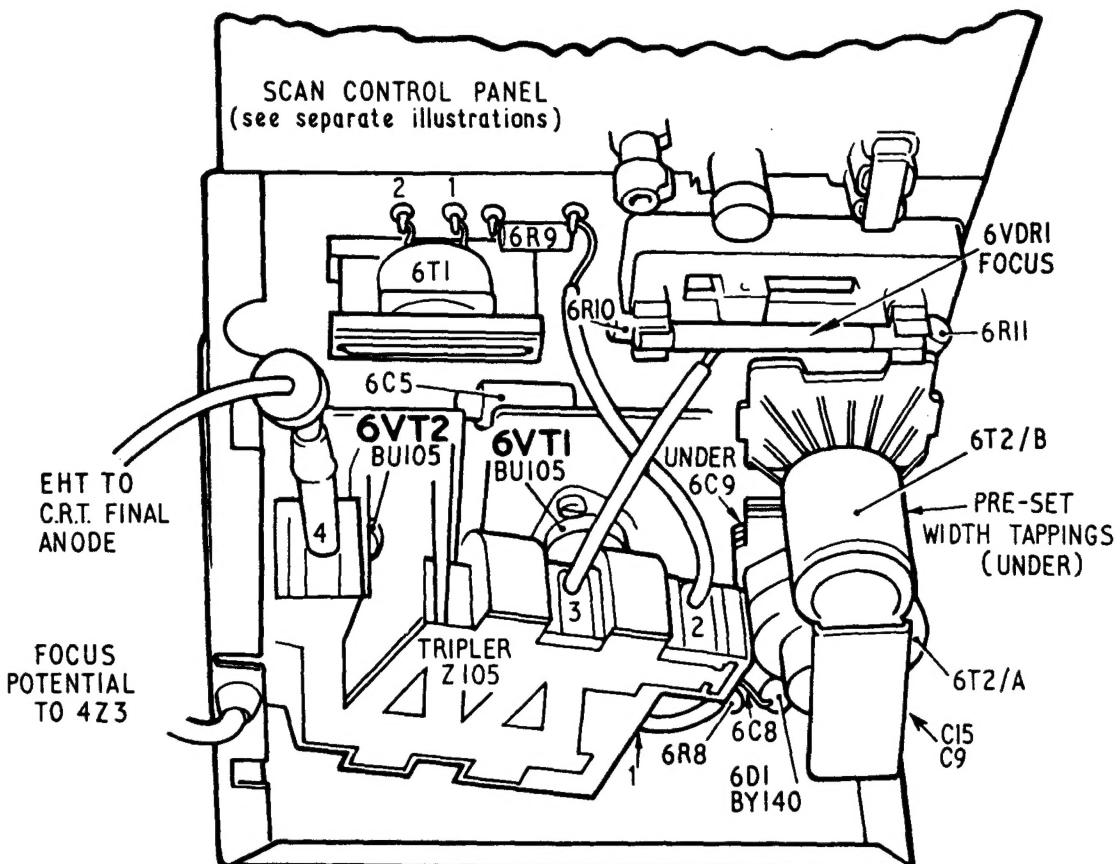
G



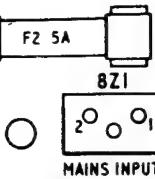
# SCAN CONTROL PANEL



5552



5549



5496

A

B

C

D

1

2

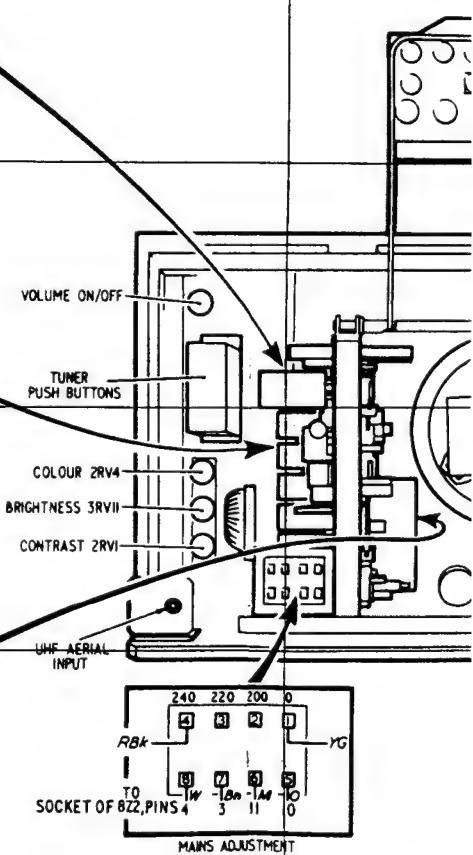
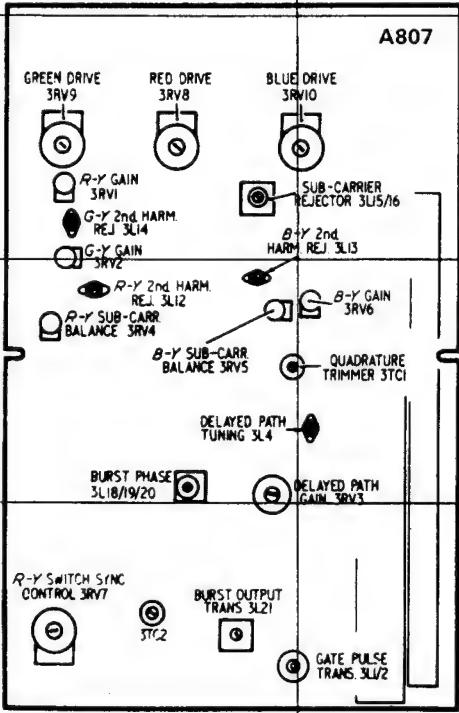
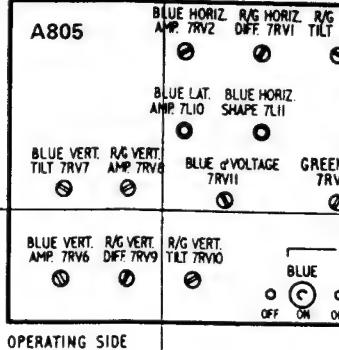
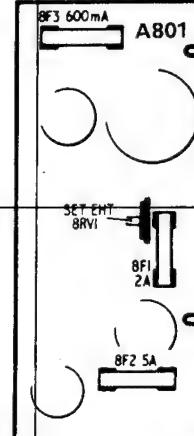
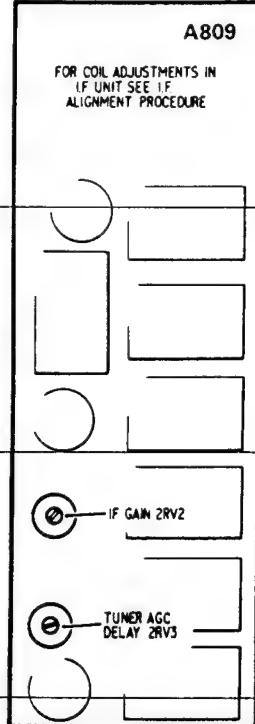
3

4

5

6

7



## KEY TO CO

### MAINS ADJUSTMENT

Mains Transformer ..... C6

Red/Green Vertical Diff.  
Red/Green Vertical Tilt  
Vertical Scan. Bal.

### GREY SCALE CONTROLS

a <sup>1</sup> Voltage, Blue .....	D1
a <sup>1</sup> Voltage, Green .....	D1
a <sup>1</sup> Voltage, Red .....	D1
Blue Drive .....	B5
Green Drive .....	A5
Red Drive .....	A5
Gun Switches .....	D2

### CONVERGENCE CONTROLS

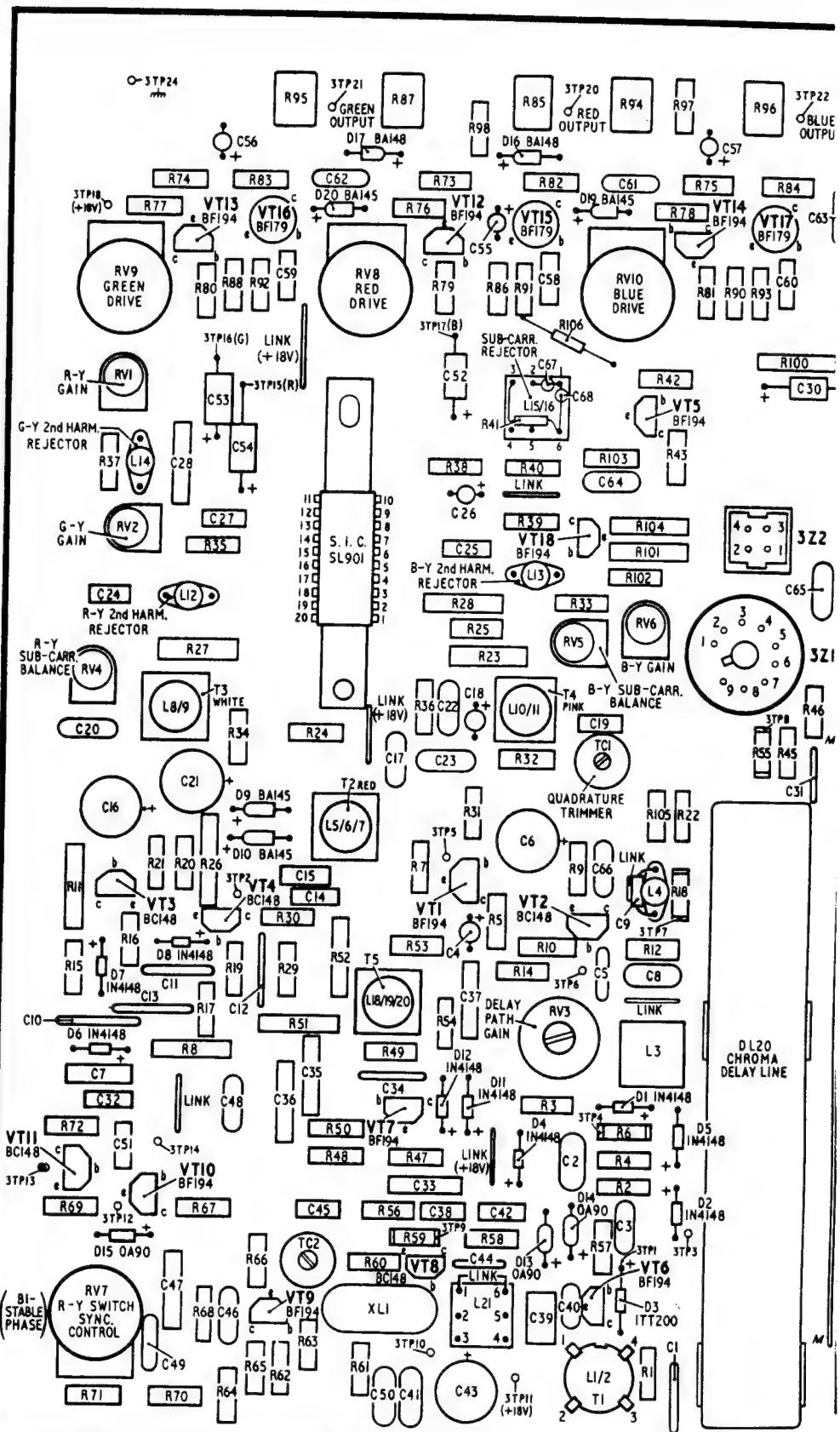
Blue Horizontal Amp. ....	D1
Blue Horizontal Shape ....	D1
Blue Horizontal Tilt ....	D1
Blue Lateral Amp. ....	D1
Blue Lateral Coils ....	F1
Blue Vertical Amp. ....	C2

### LINE TIMEBASE

E.H.T. CONTF
Discriminator Balance .....
Discriminator Transform .....
Focus .....
Horizontal Shift .....



MISC.	R	C
TP20	94	97
TP24	85	96
TP22	95	87 89
D16	98	
D17 D18	56	57
VT14	83	82 84
VT12	74	73 75
D20 TP18	62	61
VT15	77	76 78
VT16	63	
VT15	55	
RV8	99	
RV9	92	86 90
RV10	88	79 81
TP23	80	91 93
TP17	59	58 60
TP16	100	
TP15	42	44 68
RV1	42	44 30
VT5	53	
L14	43	
37	31	54
40	28	64
VT18	104	26
RV2	39	27
22	35	25
L13	102	
L12	33	65
RV6	28	24
RV5	25	
Z1	27	23
RV4		
T3 T4	46	18
L8/9 TP8	22	22
L10/II	19	
TCI	34	24 20
32	55	23
17		
T2	21	31
D9	105	
L7	31	22
16		
L5/6/7	26	
TP5	7	15
D10	21	20 9
TP2	14	14
VT4	11	10
VT2	16	14
VT3	50	9
VT1	10	
TP7	16	
D8 T5	52	4
D7 TP6	15	19 14
13	13	5
L18/9/20	37	
RV3	17	54
L3	51	10
DL20		
D12	8	49
DH	73	34
D1	3	32 36
TP4	48	
VT7	72	6
DO 45	47	51
VT11	48	2
TP14	2	33
TP13 D2	69	42
TP9	67	45 42
TP12	67	59 58
VT8	60	38 3
TC2	66	
D15 D13	44	
VT6	60	
L21	47	
RV7 D3	68	40
XLI	68	46 39
VT9	61	49
TP10	63	1
LI/2	65	43
TI	64	41
TP11	71	50



DECODER & R.G.B. DRIVE PANEL Type A807



RANK BUSH MURPHY

# CIRCUIT DESCRIPTION

## U.H.F. Tuner Type Z511

The Z511 is a four section transistorised u.h.f. tuner employing three r.f. transistors in a grounded base mode. Transistors 1VT1 and 1VT2 are used as an r.f. amplifier stage; this stage is followed by 1VT3 operating as a combined mixer and oscillator. An a.g.c. control voltage derived from the Z582 i.f. panel is applied to the base of 1VT1. Four quarter wave coaxial lines 1X2, 4, 8 and 10 are employed as tuned elements for the aerial, r.f., mixer and oscillator respectively. Each of these lines is tuned by a varicap diode (1D1, 2, 3 and 4) with trimming and bandshaping of the r.f. and oscillator stages being carried out by coupling loops. The intermediate frequency signal developed across the output coil 1L10 is passed to the i.f. amplifier on the Z582 via 2Z1. By adjusting the customer push-button channel selector, the voltage applied to the varicap diodes is varied and hence the channel to which the unit is tuned.

## A.F.C. and Power Supply Panel Z512

An i.f. signal from the Z582 is fed via 2Z5 to the base of transistor 1VT4 which acts, with 1L11 and 12, as a narrow band amplifier for 39.5 MHz. The output from this amplifier is fed to the base of 1VT5, the driver for the Foster-Seeley discrimina-

tor 1D5 and 6 etc. The output of the discriminator is zero at 39.5 MHz, but with decreasing frequency pin 6 of the Module AE goes positive and pin 7 goes negative. With increasing frequency these polarities are reversed. This resultant automatic frequency control correcting voltage is either added or subtracted, depending on its polarity, to the positive varicap control voltage set by the customer push-buttons, and appears at the wiper of 1RV2 to be fed to pin 4 of the Z511 where it is used to control the channel frequency of the tuner. The diodes 1D7 and 8 have been included to limit the a.f.c. correcting voltage to avoid an excessive pull-in range. The Hold-in Range control 1RV2 is adjusted to give a holding range of  $\pm 1$  MHz at 39.5 MHz. A switch is provided on the customer push-button unit to mute the a.f.c. system whilst tuning.

The integrated circuit 1SIC1, TAA550 stabilises the voltage derived from the +200 V line of the Z584 decoder before feeding it to the varicap push-button control unit. Transistor 1VT6 provides a stabilised supply voltage and bias for the tuner. The base voltage of 1VT6 is held steady by the action of 1SIC1 whilst 1D9 provides compensation for changes of base current due to temperature variation.

# ALIGNMENT PROCEDURE

## 1 Equipment Required

1. 1 External Bias Unit for Z582 . . . . .	(See Fig. 19, Page C-16 of TP1741).
1. 2 Oscilloscope . . . . .	Telequipment S43 or equivalent.
1. 3 Multi-range Meter . . . . .	20,000 $\Omega$ per volt.
1. 4 Sweep Generator . . . . .	providing swept i.f. signal 30 to 50MHz.
1. 5 Signal Generator, A.M./F.M. . . . .	covering 30 to 50MHz, modulated 50% at 1000Hz, terminated.
1. 6 Signal Generator, U.H.F . . . . .	covering 470 to 860MHz amplitude modulated.

## 2 Alignment of 1L10 in Z511

2. 1 Inject a swept i.f. signal into i.f. injection point at 1C29 on the side of the tuner Z511, monitor the output at 2TP8 on the Z582 I.F. Panel.
2. 2 Adjust 1L10 to position the vision carrier at 50% on the h.f. side of i.f. response (see Fig. 20, Page C-17 of TP1741).

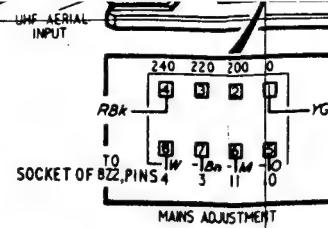
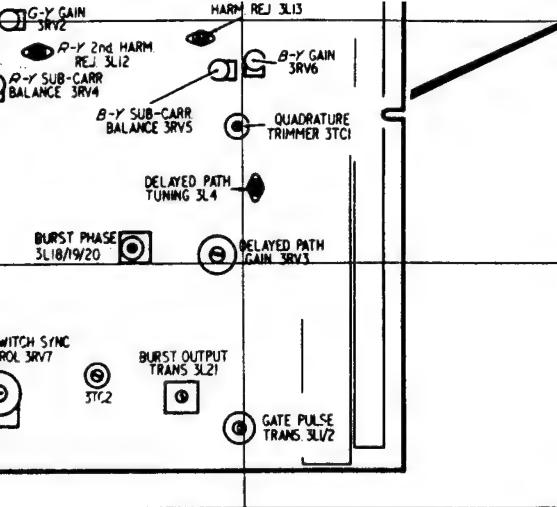
and re-check the display, then reduce the signal input level to check for any signs of instability. Disconnect signal generator and oscilloscope.

## 3 A.F.C. Bandpass Alignment

3. 1 Inject a 39.5MHz f.m. signal, modulated  $\pm 100$ kHz at 1000Hz, using an input level of 2mV, into 2Z5, 1 and 2
3. 2 Set the A.F.C. Switch, 1SW1 to the ON position and set the A.F.C. Hold-in Range control 1RV2 to its mid-position. Monitor the display at pin 6 of the F. M. Detector module (AE) on the oscilloscope.
3. 3 Set the core of 1L11 so that it is flush with the top of its former. Align 1L15, 14, 12, and 11 in that order, for maximum amplitude of display. The display will be a symmetrical sinewave with an amplitude of approx. 0.2V pk-p.k
3. 4 Change the signal generator from frequency to amplitude modulation and set the modulation depth to 50%. Adjust 1L15 only for minimum display amplitude. Revert to frequency modulation

## 4 A.F.C. Hold-in Range Check

4. 1 Connect the external bias unit (See Item 1.1) to the i.f. unit at 2TP3, 4 and 5. Switch the A.F.C. Switch to the OFF position and set the R.F. Gain control 1RV3 fully anti-clockwise.
4. 2 Inject into the u.h.f. aerial socket, a signal of 600MHz, amplitude modulated 50% at 1000Hz at a level of not less than 1mV. Tune one of the unit push-buttons to this signal, monitoring the output at 2TP8 on the oscilloscope. Adjust the external bias unit to produce a display amplitude of 2V pk-pk.
4. 3 Check that the i.f. produced is 39.5MHz by injecting a 39.5MHz into 2TP1 on the Z582 via a 1pF capacitor and observing any beat pattern on the display.
4. 4 Change the input signal frequency to 599MHz. Set 1RV2 fully anti-clockwise and 1SW1 to ON. Rotate 1RV2 slowly clockwise to a point where the display regains its undistorted amplitude of 2V pk-pk.



CV1916S

## KEY TO CONTROLS

#### **MAINS ADJUSTMENT**

**MAINS ASSISTANT**

GREY SCALE CONTROL

REPLACEMENT PARTS CONTINUED	
a <sup>1</sup> Voltage, Blue .....	D
a <sup>1</sup> Voltage, Green .....	D
a <sup>1</sup> Voltage, Red .....	D
Blue Drive .....	B
Green Drive .....	A
Red Drive .....	A
Gun Switches .....	D

## CONVERGENCE CONTROLS

CONVENIENCE CONTINUED	
Blue Horizontal Amp.	D
Blue Horizontal Shape	D
Blue Horizontal Tilt	D
Blue Lateral Amp.	D
Blue Lateral Coils	F
Blue Vertical Amp.	C
Blue Vertical Tilt	C
Horizontal Scan. Bal.	G
Purity Ring Magnets	G
Radial Static Conv. Magnets	F
Red/Green Horizontal Amp.	D
Red/Green Horizontal Diff.	D
Red/Green Horizontal Tilt	D
Red/Green Vertical Amp.	C

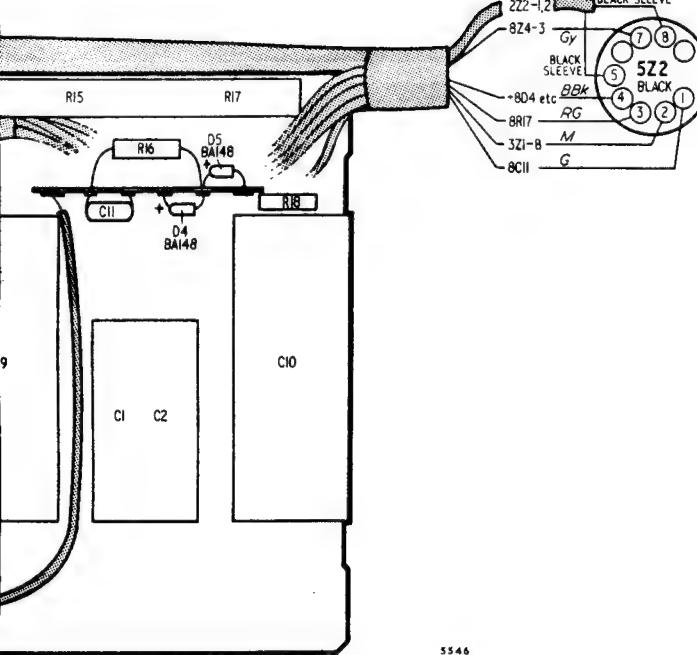
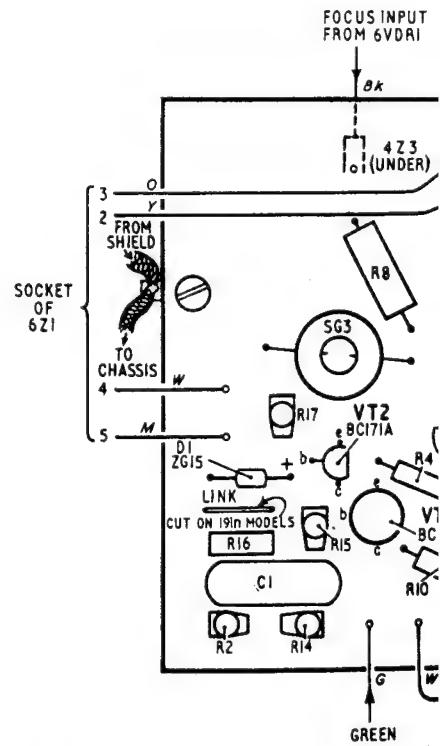
Red/Green Vertical Diff. .... C

<b>I.F. &amp; SIGNAL CONTROLS</b>	
Brightness .....	C
Colour .....	C
Contrast .....	C
I.F. Gain .....	A
Tuner A.G.C. Delay .....	C
Tuner Push Buttons .....	C
Volume On/Off .....	G

#### **DECODER CONTROLS**

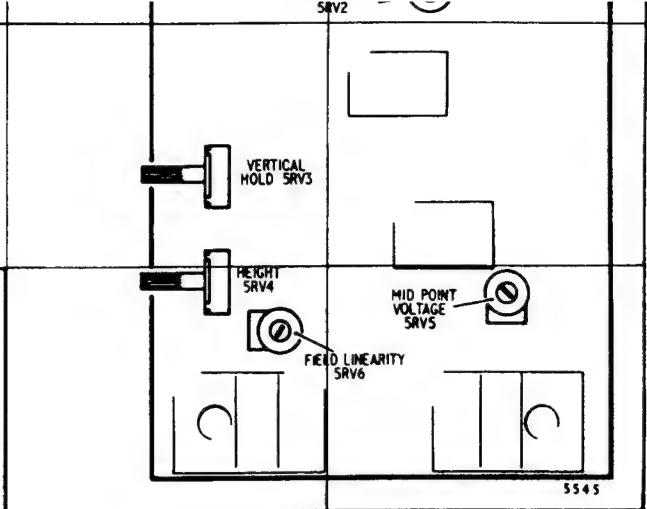
<b>DECODER CONTROLS</b>	
Burst Output Transformer . . . . .	A7
Burst Phase Transformer . . . . .	A6
Delayed Path Gain . . . . .	A6
Delayed Path Tuning . . . . .	B6
B-Y Gain . . . . .	B6
G-Y Gain . . . . .	A5
R-Y Gain . . . . .	A5
Gate Pulse Transformer . . . . .	A7
Quadrature Trimmer . . . . .	B6
B-Y 2nd Harmonic Rejector . . . . .	A6
G-Y 2nd Harmonic Rejector . . . . .	A5
R-Y 2nd Harmonic Rejector . . . . .	A6
B-Y Sub-Carrier Balance . . . . .	A6
R-Y Sub-Carrier Balance . . . . .	A6
Sub-Carrier Rejector . . . . .	A5
R-Y Switch Sync. Control . . . . .	A7
3TC2 . . . . .	A7

MISC.	R	C
Z3 D2	1	11
SG9		
SG1	3	
	8	5
Z1		
SG3	13	
VT2	17	
DI VI		
SG8	4	
SG6		
VT1	15	9
	16	6
		7
	10	
SG7		
SG2	2	14
SG5		
SG4		



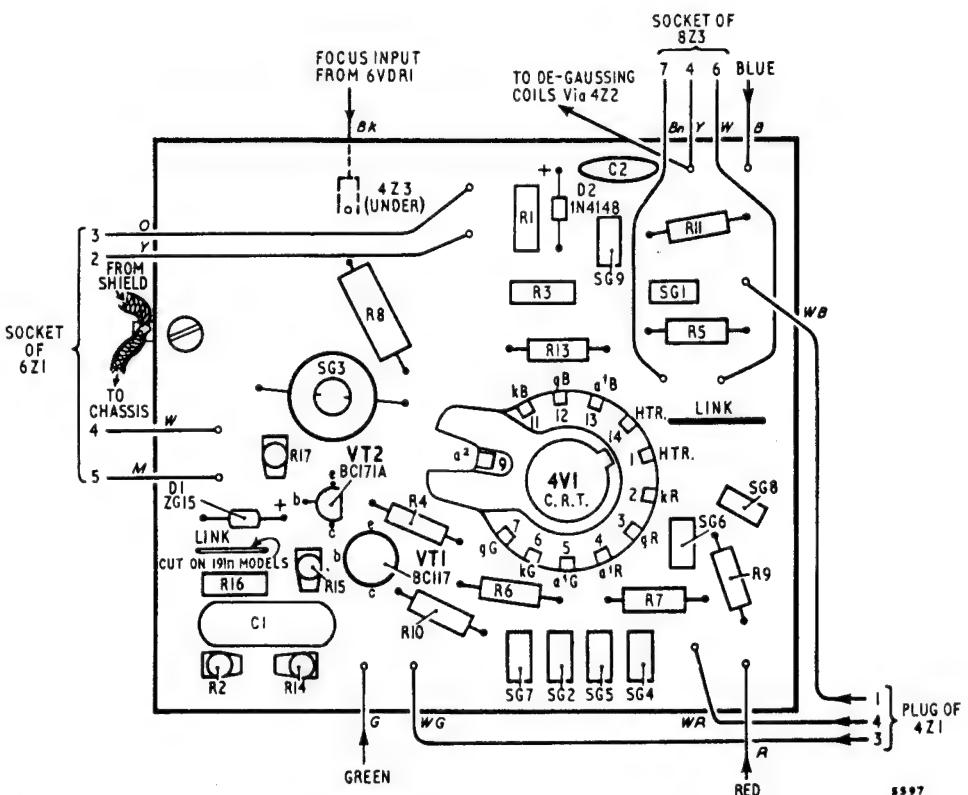
# CONTROLS

Vertical Diff.	C2	Height	E5 & F7
Vertical Tilt	D2	Mid-Point Voltage	G7
Vertical Bal.	G3	Pin-Cushion Amp.	G3
SIGNAL CONTROLS	C5	Pin-Cushion Phase	G3
	C5	Vertical Hold	E5 & F6
	C5	Vertical Shift	G3
DECODER CONTROLS	A3	Burst Output Transformer	A7
	A3	Burst Phase Transformer	A6
	C4	Delayed Path Gain	A6
	C4	Delayed Path Tuning	B6
TIMEBASE &		B-Y Gain	B6
L.T. CONTROLS		G-Y Gain	A5
Balance	G5	R-Y Gain	A5
Transformer	G5	Gate Pulse Transformer	A7
Shift	E5	Quadrature Trimmer	B6
Sync	F5	B-Y 2nd Harmonic Rejector	A6
V	G3	G-Y 2nd Harmonic Rejector	A5
Protection	G5	R-Y 2nd Harmonic Rejector	A6
ings.	B2	B-Y Sub-Carrier Balance	A6
	E5	R-Y Sub-Carrier Balance	A6
LD CONTROLS		Sub-Carrier Rejector	A5
ty	F7	R-Y Switch Sync. Control	A7
		3TC2	A7

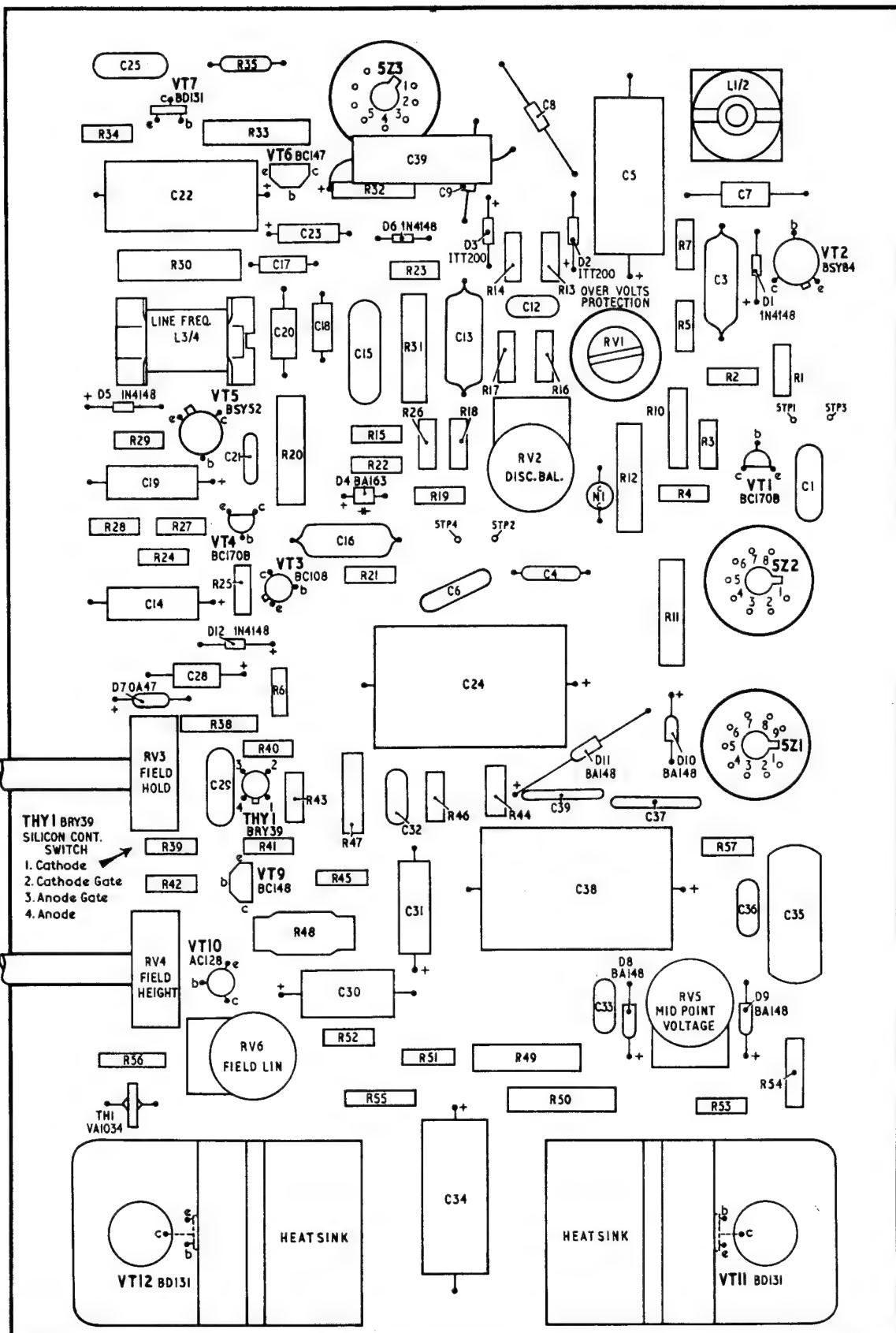


MISC	R	C
Z3	35	25
VT7 LI/2		8
	34 33	
VT6	39	5
	32	22 9 7
D6	23	
D3	23	
VT2	7	17
D2	30	17
	23	17
DI	14	13
	14	13
L3/4	5	18
RV1	20	13
	31	15
VT5	2	
D5	17	
TP1 TP3	16	
	26	10
	18	10
RV2	15	3
	20	21
D4	12	19
VT1	19	4
N1		
TP4 TP2	28	
VT4	27	16
VT3	24	4
Z2	21	
25	6	
DI2		14
D7	6	28
		24
D11	38	
RV3	21	29
D0	40	
		29
THY1	43	
	44	39 37
	39 41 47	32
VT9	45	
	42	38 36
		31 35
VT10	48	
RV4 D8		
RV5	49	30
	50	33
RV6	52	
	51	54
	49	
TH1	50	55 53
		34
VT11		
VT12		

THY1 8  
SILICON  
SWI  
1. Cathode  
2. Cathode  
3. Anode  
4. Anode



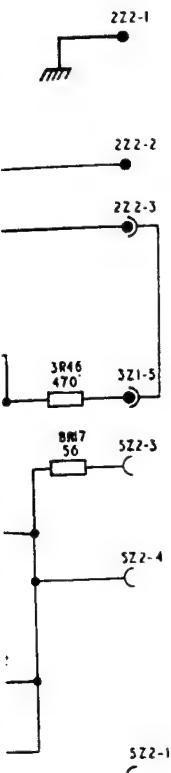
MISC	R	C
Z3	35	25
VT7 LU/2		8
	34 33	
VT6	32	39 5
D6	23	
D3	23	
VT2	22	9 7
D2	30	7 17 3
DI	13	12
L3/4	5 18	
RV1	20 13	
	15	
VT5	2 1	
D5	16	
TP1 TP3	26 10	
RV2	29 15 3	
D4	20 22	
VT1	12 19	1
NI	19 4	
TP4 TP2	28 27	
VT4		16
VT3	24 21 4	
Z2	25 6	6
D12	14	
07	28	
D11 Z1	24	
RV3 D10	38 40	
	29	
THY1	43 44	39 37
	46 44	32
	39 41 57	
VT9	42 45	38 36
	31 35	
VT10	48	
RV4 D8		
RV5 D9	30 33	
RV6	52	
	51	
	49	
	54	
TH1	50 55 53	
	34	
VT11		
VT12		



SCAN DRIVE PANEL Type A803

# VOLTAGES

These voltages were obtained using a typical receiver under average signal conditions on a mains input of 240V a.c. A 20,000 ohms/volt meter was used with a suitable adaptor for measuring the E.H.T. and Focusing potential. All voltages are positive with respect to chassis unless otherwise stated. N.T. indicates no test.

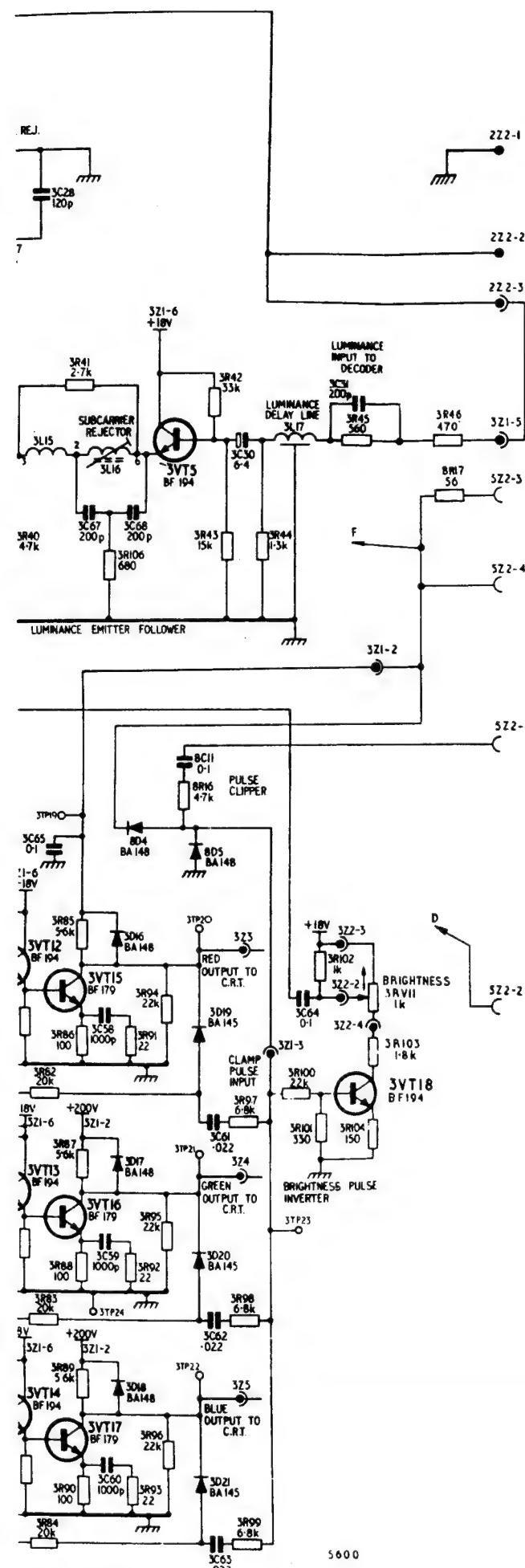


R103

1.8 k

SVT18  
(F104)

Ref.	Type	Electrode Voltage			Remarks
		emitter	base	collector	
1VT1	BF180	N.T.	N.T.	N.T.	
1VT2	BF171	N.T.	N.T.	N.T.	
2VT1	BF196	3.3	4.0	7.3	
2VT2	BF194	11.0	11.5	18.0	
2VT3	BF197	3.9	4.5	10.0	
2VT4	BF197	8.1	7.0	15.0	
2VT5	BC148	4.0	4.5	15.5	Depends on setting of 2RV2
2VT6	BC158	19.0	18.5	7.5	Depends on setting of 2RV3
2VT7	BC148	3.6	2.5	8.0	
2VT8	BC196	7.0	8.0	15.0	
2VT9	BF197	2.5	3.2	16.5	
2VT10	BC148	1.0	1.6	6.5	
2VT11	BC148	6.0	6.5	17.0	
2VT12	BC153	1.2	3.0	12.2	
2VT13	BC113	0.7	1.2	12.5	
2VT14	BC107	—	0.7	12.5	
2VT15	AC176	12.6	13.0	25.0	
2VT16	AC128	12.6	12.5	—	
3VT1	BF194	—	0.5	0.1	
3VT2	BC148	1.9	2.1	17.0	Depends on setting of 3RV3
3VT3	BC148	—	0.5	6.0	Colour on
3VT4	BC148	—	0	12.0	Colour off
3VT5	BF194	5.1	5.6	18.0	Colour on
3VT6	BF194	2.2	3.0	18.0	Colour off
3VT7	BF194	0	-3.6	-2.1	
3VT8	BC148	0	0	18.0	
3VT9	BF194	0.6	0.9	10.0	Colour on
		1.5	2.1	10.0	Colour off
3VT10	BF194	2.8	3.0	18.0	
3VT11	BC158	18.0	17.2	17.3	Colour on
		18.0	17.4	0.6	Colour off
3VT12	BF194	2.0	2.5	18.0	Bright. max.
		1.4	2.0	18.0	Bright. min.
3VT13	BF194	2.0	2.5	18.0	Bright. max.
		1.4	2.0	18.0	Bright. min.
3VT14	BF194	2.0	2.5	18.0	Bright. max.
		1.4	2.0	18.0	Bright. min.
3VT15	BF179	1.5	2.0	100	Bright. max.
		0.8	1.7	125	Bright. min.
3VT16	BF179	1.5	2.0	100	Bright. max.
		0.8	1.7	125	Bright. min.
3VT17	BF179	1.5	2.0	100	Bright. max.
3VT17	BF179	0.8	1.7	125	Bright. min.
3VT18	BF194	0.25	0.3	16.0	
8VT1	BC147	-0.2	-1.5	10.0	
8THY1	BT106	Cathode	Anode	Gate	
		N.T.	N.T.	N.T.	



## **VOLTAGES**

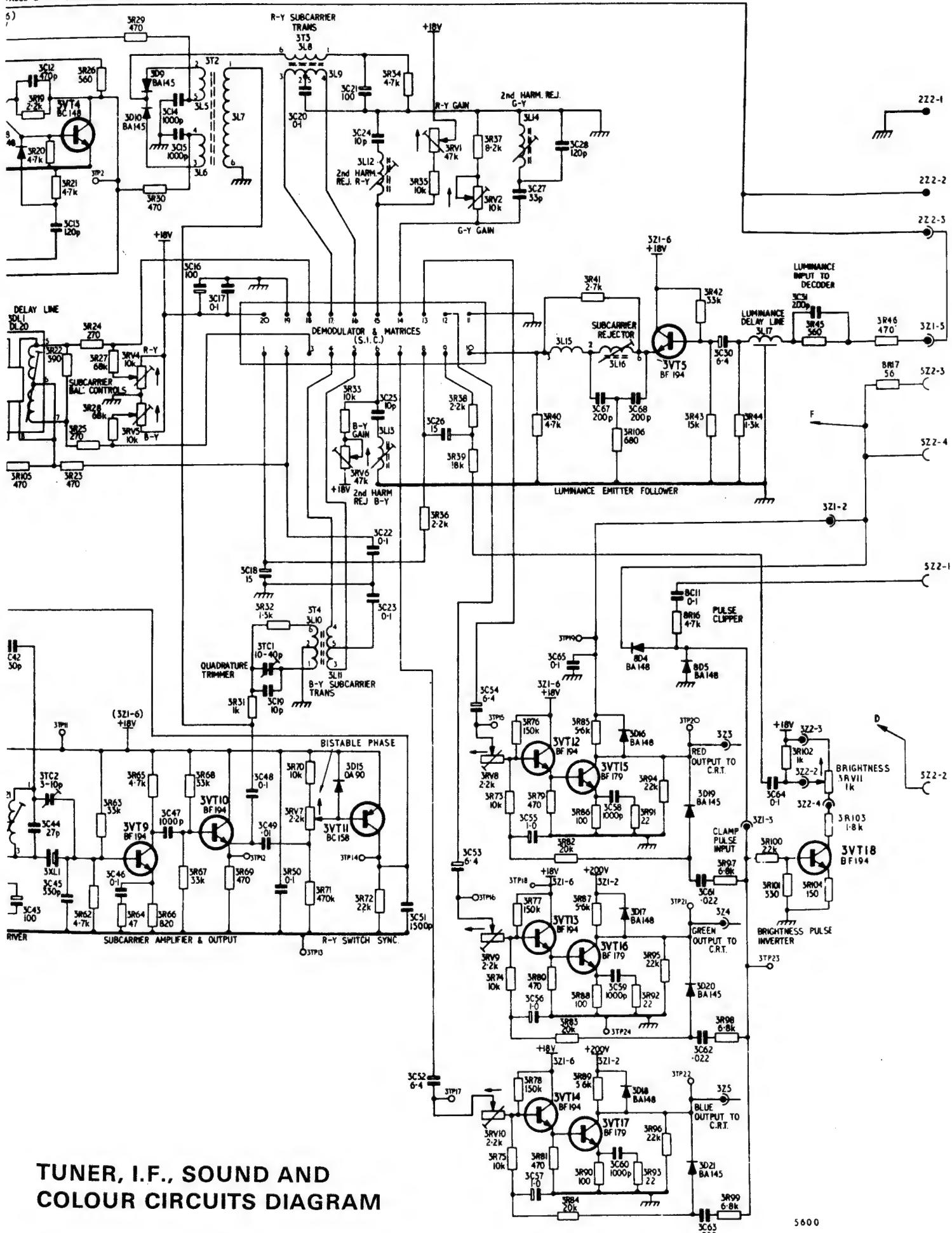
These voltages were obtained using a typical receiver under conditions on a mains input of 240V a.c. A 20,000 ohms/volt m.s. suitable adaptor for measuring the E.H.T. and Focusing potentials are positive with respect to chassis unless otherwise stated.

Ref.	Type	Electrode Voltage			Remark
		emitter	base	collector	
1VT1	BF180	N.T.	N.T.	N.T.	
1VT2	BF171	N.T.	N.T.	N.T.	
2VT1	BF196	3.3	4.0	7.3	
2VT2	BF194	11.0	11.5	18.0	
2VT3	BF197	3.9	4.5	10.0	
2VT4	BF197	8.1	7.0	15.0	
2VT5	BC148	4.0	4.5	15.5	Depend.
2VT6	BC158	19.0	18.5	7.5	Depend.
2VT7	BC148	3.6	2.5	8.0	
2VT8	BC196	7.0	8.0	15.0	
2VT9	BF197	2.5	3.2	16.5	
2VT10	BC148	1.0	1.6	6.5	
2VT11	BC148	6.0	6.5	17.0	
2VT12	BC153	1.2	3.0	12.2	
2VT13	BC113	0.7	1.2	12.5	
2VT14	BC107	—	0.7	12.5	
2VT15	AC176	12.6	13.0	25.0	
2VT16	AC128	12.6	12.5	—	
3VT1	BF194	—	0.5	0.1	Depend.
3VT2	BC148	1.9	2.1	17.0	Colour
3VT3	BC148	—	0.5	6.0	Colour
3VT4	BC148	—	0	12.0	Colour
3VT4	BC148	—	0.5	6.0	Colour
3VT4	BC148	—	0.8	0.5	Colour
3VT5	BF194	5.1	5.6	18.0	
3VT6	BF194	2.2	3.0	18.0	
3VT7	BF194	0	-3.6	-2.1	
3VT8	BC148	0	0	18.0	
3VT9	BF194	0.6	0.9	10.0	Colour
3VT9	BF194	1.5	2.1	10.0	Colour
3VT10	BF194	2.8	3.0	18.0	
3VT11	BC158	18.0	17.2	17.3	Colour
3VT11	BC158	18.0	17.4	0.6	Colour
3VT12	BF194	2.0	2.5	18.0	Bright.
3VT12	BF194	1.4	2.0	18.0	Bright.
3VT13	BF194	2.0	2.5	18.0	Bright.
3VT13	BF194	1.4	2.0	18.0	Bright.
3VT14	BF194	2.0	2.5	18.0	Bright.
3VT14	BF194	1.4	2.0	18.0	Bright.
3VT15	BF179	1.5	2.0	100	Bright.
3VT15	BF179	0.8	1.7	125	Bright.
3VT16	BF179	1.5	2.0	100	Bright.
3VT16	BF179	0.8	1.7	125	Bright.
3VT17	BF179	1.5	2.0	100	Bright.
3VT17	BF179	0.8	1.7	125	Bright.
3VT18	BF194	0.25	0.3	16.0	
8VT1	BC147	-0.2	-1.5	10.0	
		Cathode	Anode	Gate	
8THY1	BT106	N.T.	N.T.	N.T.	

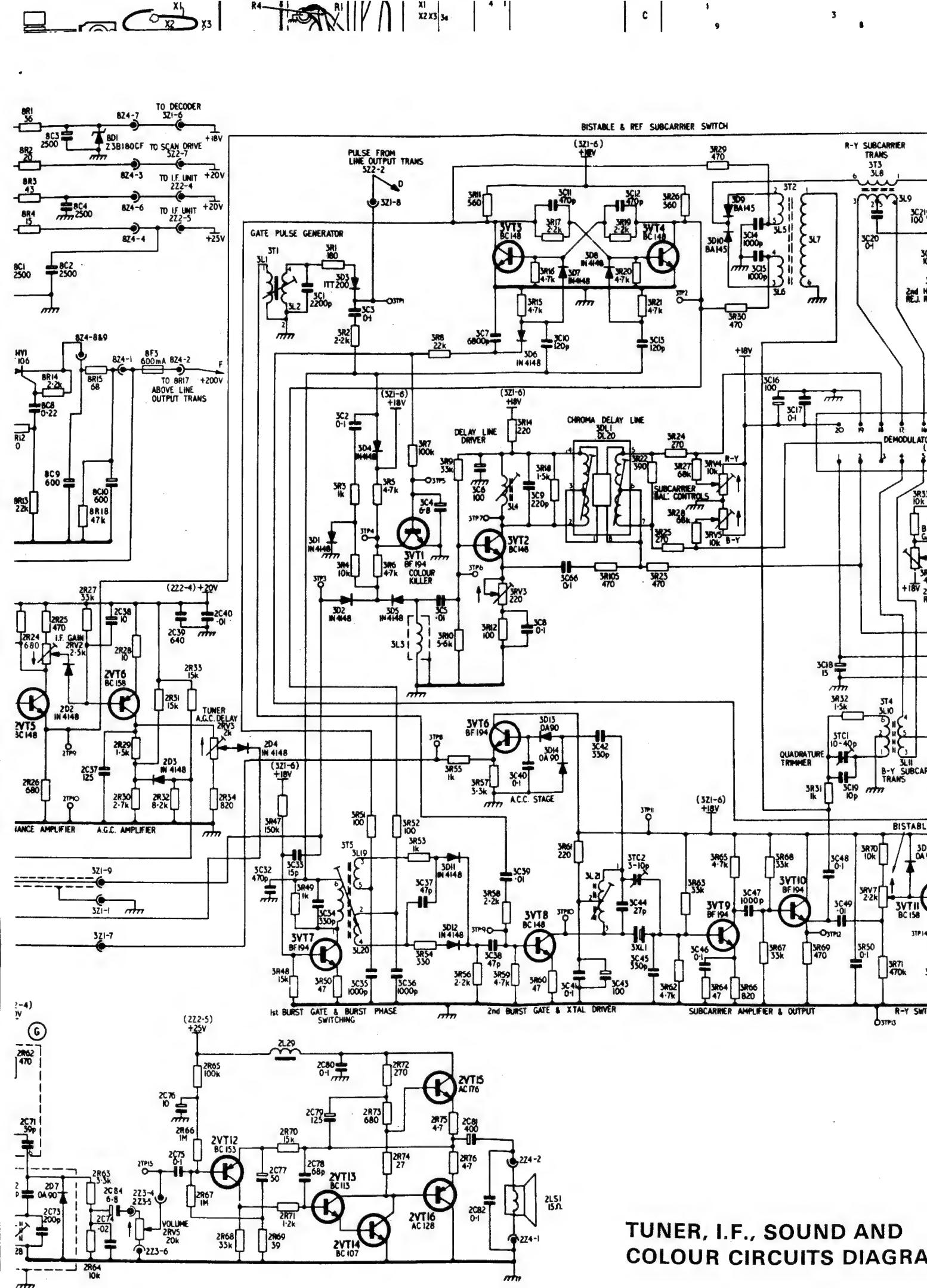
Depend

Depend  
Colour  
Colour  
Colour  
Colour

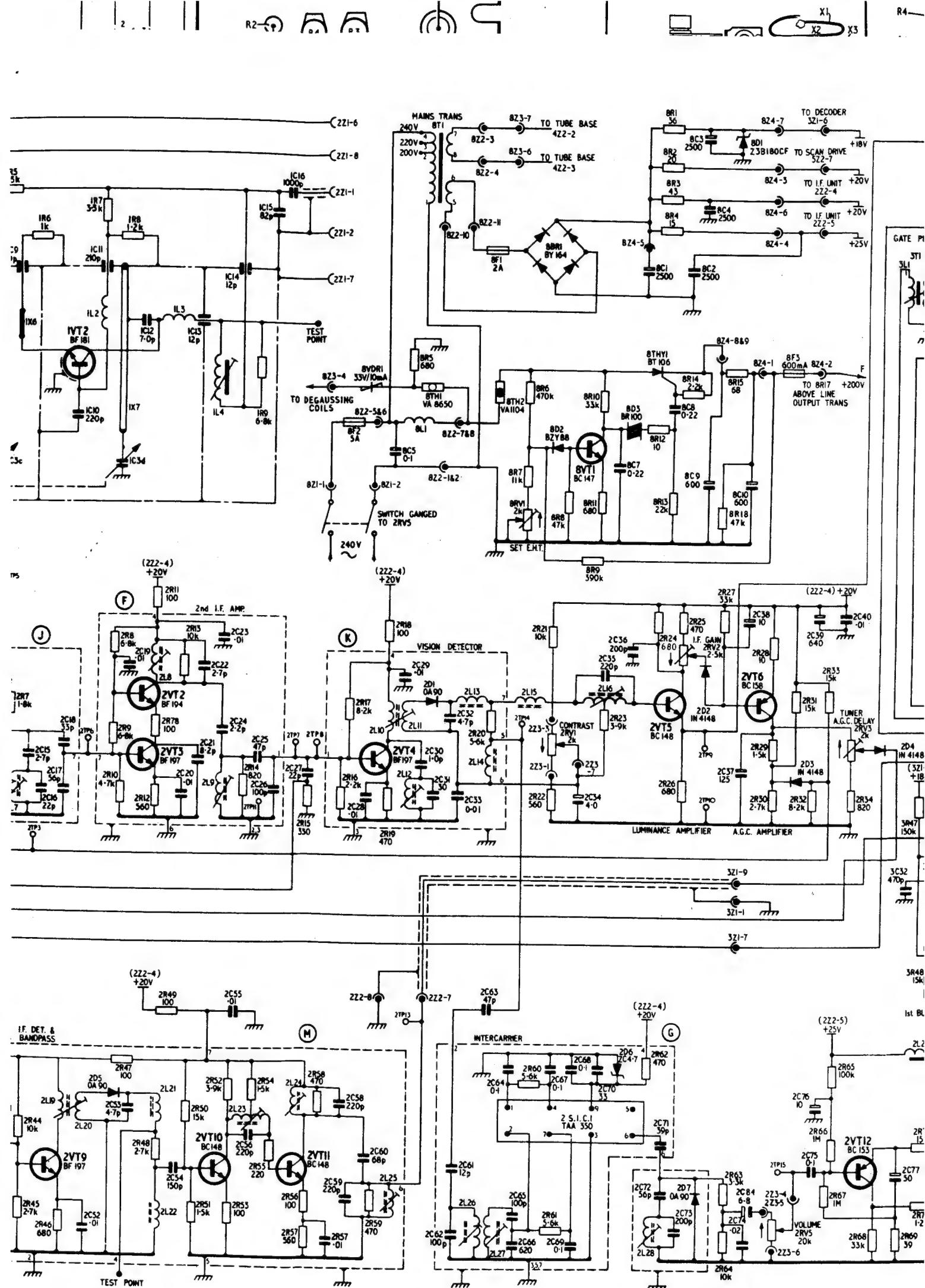
TABLE 8 REF SUBCARRIER SWITCH



## **TUNER, I.F., SOUND AND COLOUR CIRCUITS DIAGRAM**



TUNER, I.F., SOUND AND  
COLOUR CIRCUITS DIAGRAM



## 5 Stabilising Voltage Check

5. 1 Check that 1S1C1 (TAA550) is stabilising the voltage at 1Z3 pin 8 at 33V,  $\pm 1\text{V}$ . Check that the supply to pin 3 of the Z511 is 12V,  $\pm 1\text{V}$ .

## 6 Tuning Range

6. 1 With the u.h.f. signal generator connected to the tuner aerial socket, and the A.F.C. Switch 1SW1 in the OFF position, check that the frequency coverage of the tuner is at least 470.75MHz to 853.75MHz. The signal should be

amplitude modulated 50% at 1000Hz and the output monitored on the Z582 at 2TP8, with the oscilloscope. After completing this check disconnect the signal generator and oscilloscope.

## 7 R.F. Gain Control, 1RV3, Setting

7. 1 With no signal input applied, monitor the voltage at Pin 1 of the tuner unit Z511 with the meter, Item 1. 3, set to its 10V range. Adjust 1RV3 to produce 2.8V at this point.

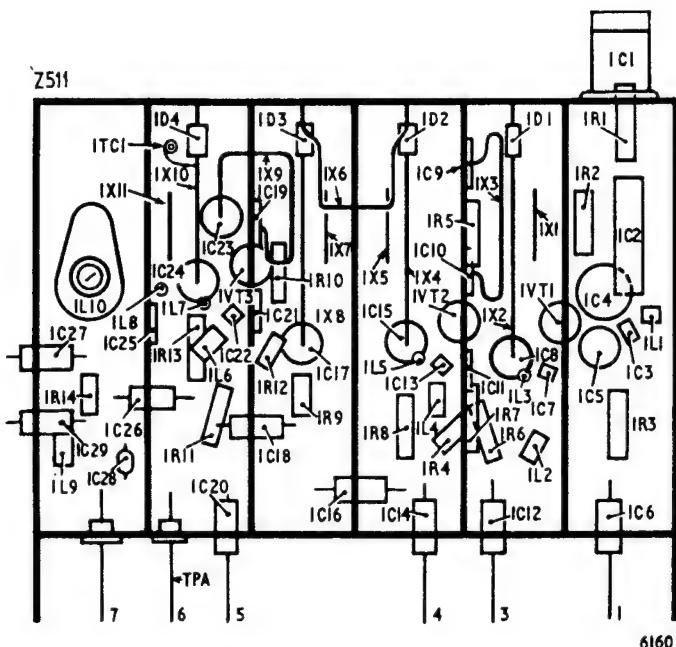


Fig. 1 Component Layout, Tuner type Z511

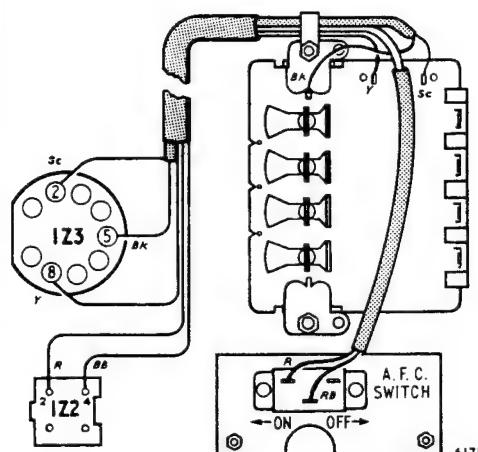


Fig. 2 Customer Control Unit  
Interconnection Diagram

## ADJUSTMENT PROCEDURE

The adjustment procedure for the Z584 decoder is identical to that for the Z180 decoder, as printed TP1741 Service Information, apart from Sections 23 to 26, Identity Control (Final Adjustment). These adjustments should be now made as follows:

### 1 Reference Levels

1. 1 Inject a colour bar signal at the aerial socket and monitor the output on the oscilloscope at 3TP7. Adjust the Pre-set Colour control 2RV6 on the Z582 panel to provide 600mV, pk-pk of U reference output at 3TP7.
1. 2 Transfer the oscilloscope to 3TP1 and adjust the Burst Gain control 3RV2 for 450mV pk-pk of the red colour bar at 3TP1.
1. 3 Recheck operations 1. 1 and 1. 2 above to achieve the figures quoted.

### 2 Identity Adjustment

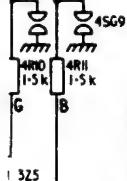
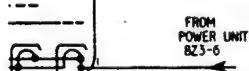
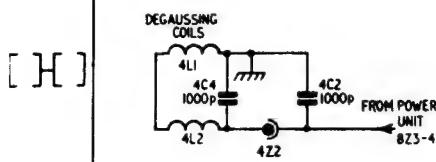
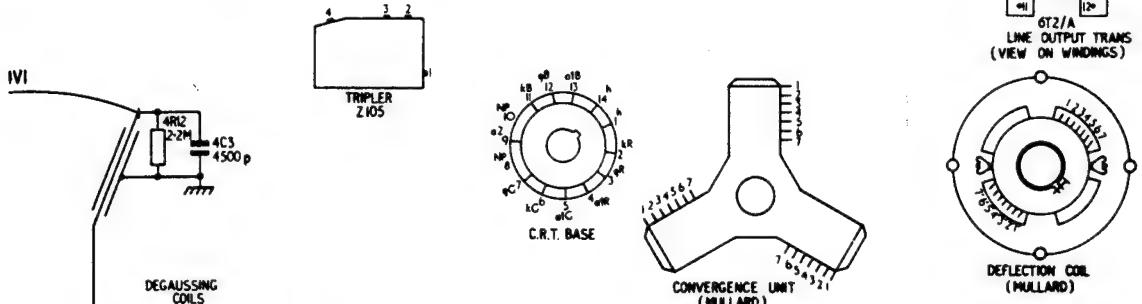
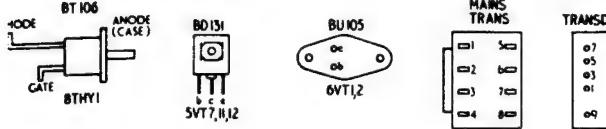
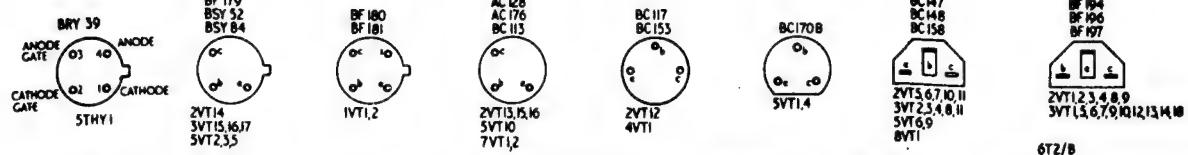
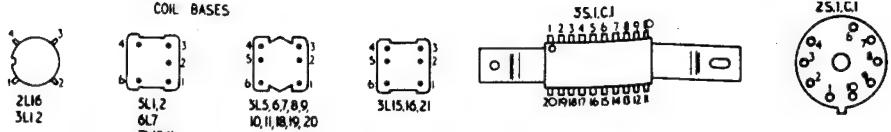
2. 1 Connect a  $10\text{k}\Omega$  resistor (preferably  $\pm 1\%$  tolerance) between 3TP8 and the wiper of the Identity control 3RV4. Turn the Identity control 3RV4 fully clockwise.

2. 2 De-couple the bi-stable trigger pulse momentarily by connecting a  $10\mu\text{F}$  capacitor between the link to pin 5 of the SL917A and chassis (3TP4) and then removing it, until the circuit goes into the 'reverse ident' condition (low saturation, reverse phase colours).

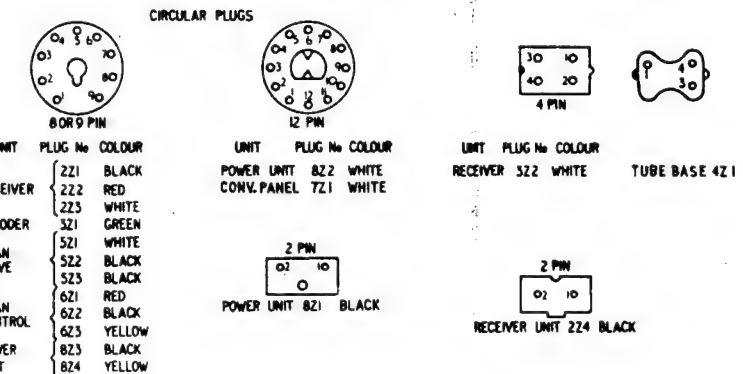
2. 3 Rotate the Identity control slowly anti-clockwise until correct ident just occurs.
2. 4 Interrupt the bi-stable trigger pulse 15 to 20 times (See 2. 2 above) to ensure that reverse ident does not occur after interruption of pulse. If it does, rotate 3RV4 a few degrees further anti-clockwise, and repeat.

### 3 Colour Killer Check

3. 1 Remove the  $10\text{k}\Omega$  resistor and insert a  $27\text{k}\Omega \pm 1\%$  resistor between 3TP8 and chassis (3TP4).
3. 2 Change channels by depressing a tuner push-button and ensure that the display does not 'colour kill', if it does repeat section 2 above.



9 SPARK GAP PROTECTORS AS SHOWN IN C.R.T. BASE CIRCUIT ARE DETAILED IN FOLLOWING TABLE		
CCT NO.	SPARK VOLTAGE	CAPACITY
4SG124.5	1.5KV	0.5p
4SG678.9	± 0.5KV	
4SG3	6-BKV	



UNIT PLUG NO COLOUR

POWER UNIT 822 WHITE

CONV. PANEL 721 WHITE

RECEIVER 322 WHITE

TUBE BASE 4Z1

#### CONVERGENCE COILS

CONVERGENCE	MULLARD	PLESSEY
LINE R.G.B.	4.5	7.8
LINE R.G.B.	6.7	5.6
FIELD R.G.B.	3	1.2
FIELD R.G.B.	2	3.4

INDICATES CLOCKWISE  
ROTATION OF  
VARIABLE RESISTORS

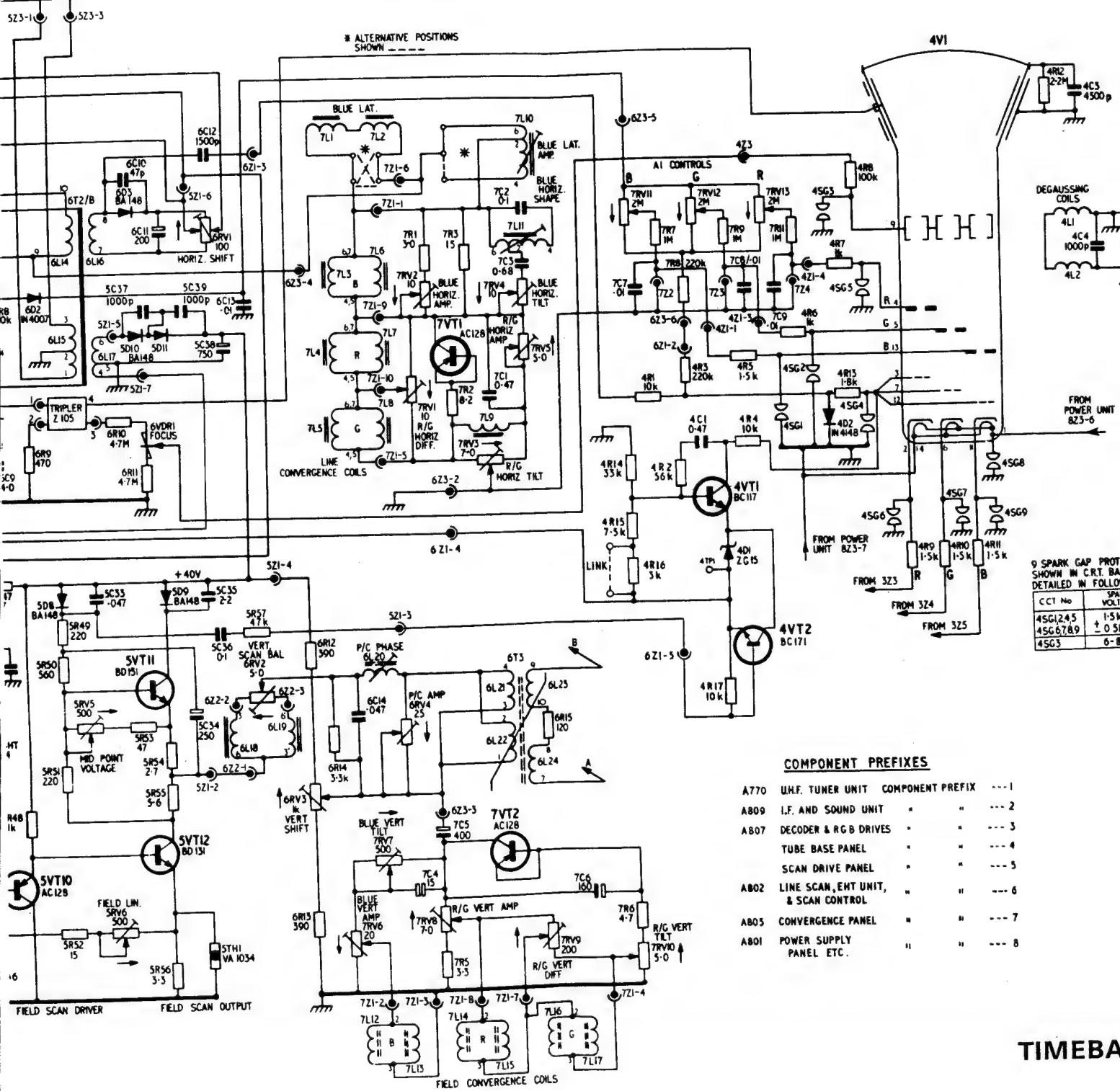
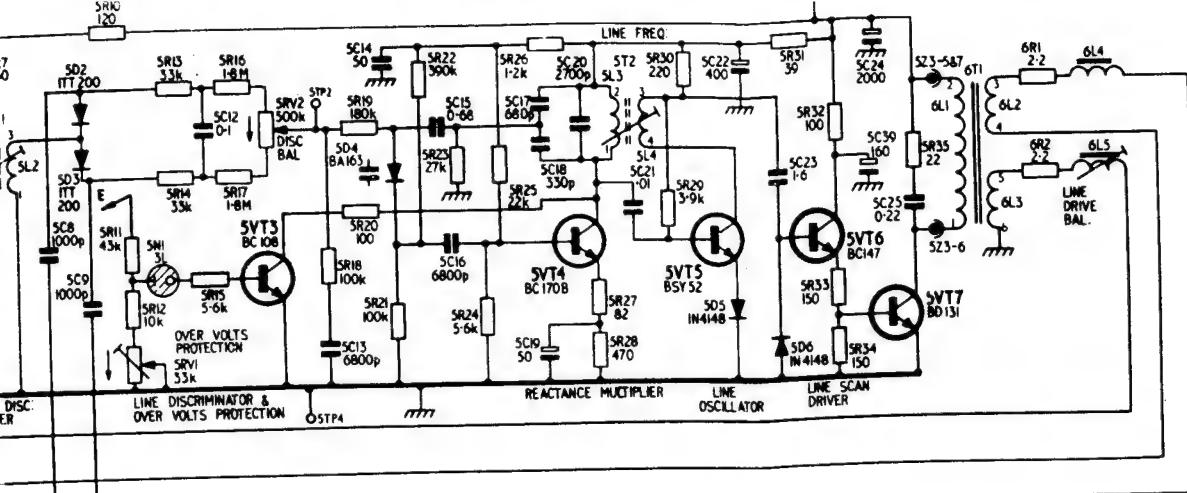
#### SCAN COILS

SCAN	MULLARD	PLESSEY
LINE	1.2	6.14
LINE	1.2'	7.13
FIELD	6.3'	1.11
FIELD	3.6'	4.8

KEY TO PLUGS & TRANSISTORS  
VIEWED ON PINS  
COILS VIEWED ON WINDINGS

RESISTOR VALUES IN OHMS  
CAPACITOR VALUES IN MICROFARAD  
UNLESS OTHERWISE STATED

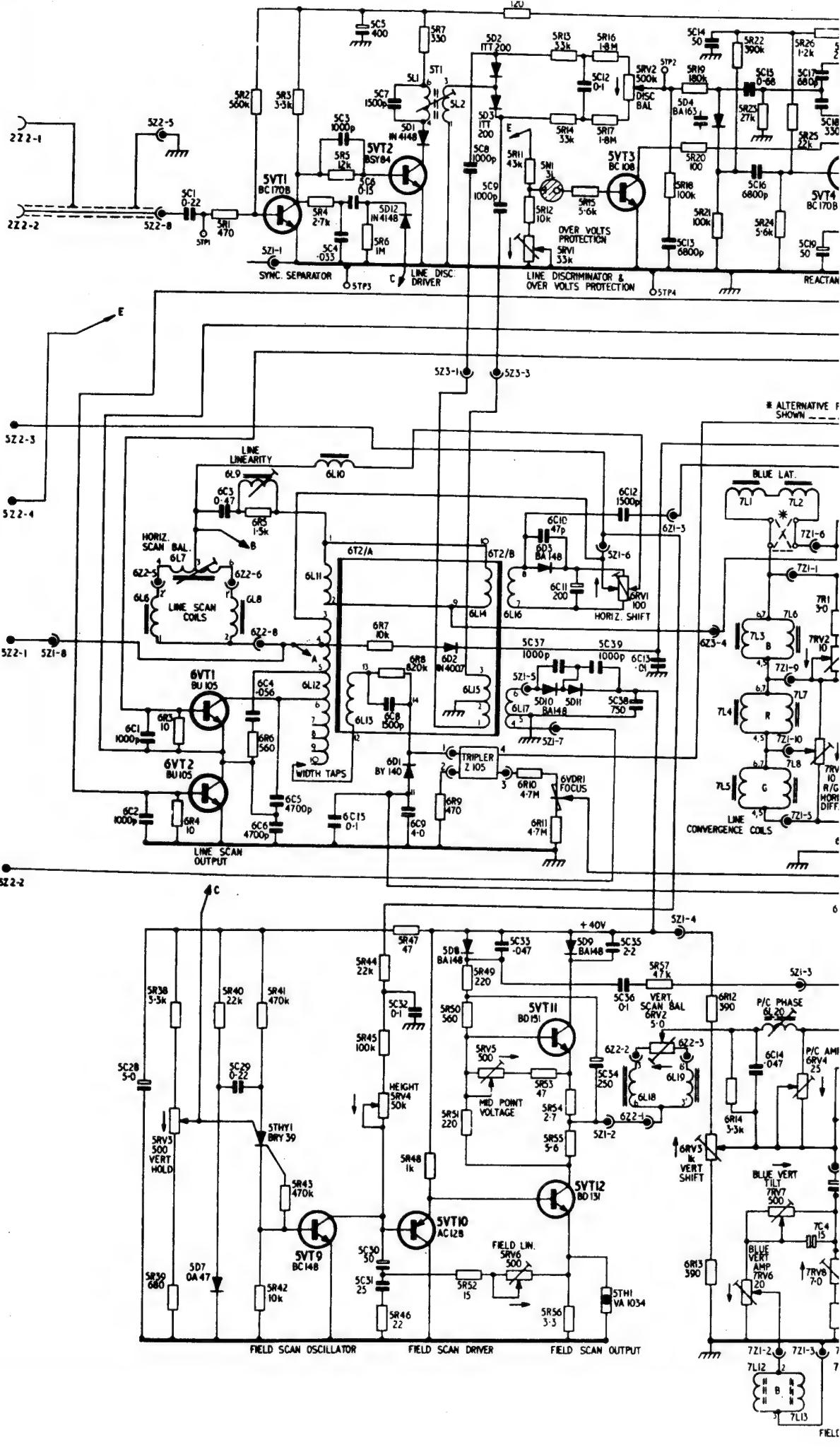




## COMPONENT PREFIXES

A770	U.H.F. TUNER UNIT	COMPONENT PREFIX	---	1
A809	I.F. AND SOUND UNIT	"	"	--- 2
A807	DECODER & RGB DRIVES	"	"	--- 3
	TUBE BASE PANEL	"	"	--- 4
	SCAN DRIVE PANEL	"	"	--- 5
A802	LINE SCAN, EHT UNIT, & SCAN CONTROL	"	"	--- 6
A805	CONVERGENCE PANEL	"	"	--- 7
A801	POWER SUPPLY PANEL ETC	"	"	--- 8

TIMEBA



## SERVICE INFORMATION

### MODELS CTV182S, CTV184S, CT187CS, CV1916S, CV2211S, CT2516CS

### Single Standard Colour Television Receivers

*This range of television receivers is fully transistorised and the transistors which are employed are robust and reliable under normal operating conditions. However, it is necessary to stress the need to apply the precautions usual when servicing a transistorised receiver i.e. avoiding short-circuits by crocodile clips, leakage currents and/or overheating from a soldering iron particularly in the time-base section of the instrument.*

#### INSTALLATION

NOTE :—The adjustment of the picture controls, i.e. Height, Hold, etc. follows standard practice.

1. **Mains Adjustment.** The receiver as supplied is suitable for a 240 volts a.c. supply. If the receiver is modified for operation on voltages other than 240 volts a.c. this must be noted on the rear of the cabinet back.

2. **Degaussing.** Automatic degaussing is fitted which will normally take care of any magnetic effects induced into the screen. Use an external degaussing coil if required.

3. **Push Button Selection.** To tune, press in the appropriate button and allow it to return to its normal operating position. Withdraw the button slightly and turn it until the receiver is correctly tuned to the desired channel.

NOTE :—Clockwise rotation of a button selects channels in a descending order of frequency.

4. **Tuner AGC Delay Control.** This control should not be adjusted but if its setting has been inadvertently disturbed, however, the slider of the control should be rotated fully clockwise and left in this position.

5. **Purity.** If necessary, adjust the Purity Ring magnets for satisfactorily pure fields on each gun.

6. **Convergence.** Refer to diagram on convergence panel.

#### MAINTENANCE ADJUSTMENTS

*This information is included to enable the correct adjustment of the undermentioned controls to be made in the event of any of these controls being accidentally disturbed.*

##### 1. Pre-set I.F. Gain

1. Set the Brightness and Contrast Controls to a midway position.

2. Adjust the Pre-set I.F. Gain control 2RV2 (see I.F. Unit diagram) for a correctly contrasted picture.

3. To check, turn the Contrast control fully clockwise and then operate the channel push buttons. If the contrast level is incorrect resulting in over-loading reduce slightly the setting of the pre-set I.F. Gain control. Re-adjust Brightness and Contrast controls to normal operating positions.

##### 2. Grey Scale

1. Switch on, with no signal input.

2. Remove tuner socket 2Z1 from the i.f. unit to obtain a noise-free raster.

3. Set the R. G. & B. drive controls 3RV8, 3RV9, 3RV10 (see Decoder panel diagram) to maximum, the A1 controls 7RV11 7RV12, 7RV13 (see Convergence Panel diagram) to minimum and the Brightness control to maximum.

4. Adjust the A1 controls in this order (leave all gun switches ON).

(a) the Green A1 control 7RV12, to a just visible green raster.

(b) the Red A1 control 7RV13 until red is just introduced into the raster.

(c) the Blue A1 control 7RV11 until blue is just introduced into the raster.

5. Restore the tuner socket and the signal, adjust the Contrast control to a normal picture and set the Brightness control for the correct black level.

6. Adjust the appropriate A1 control to remove colouration if any, in the lowlights close to black level.

7. Adjust, if necessary, the appropriate drive control for no colouration in the peak white areas (Illuminant D).

8. Check that the overall grey scale is satisfactory.

##### 3. Focus

The Focus control 6VDR1 is adjusted, using an insulated screwdriver, through a hole in the e.h.t. compartment cover. (see Controls Diagram).

##### 4. Set E.H.T.

This control is set for an e.h.t. of 25kV measured under signal conditions with zero brightness on the c.r.t. screen using a high voltage meter whose impedance is not less than 30M ohms.

##### 5. E.H.T. over-volts protection control

This control should not be disturbed from its setting, as indicated by the paint spot, without reference to the recommended procedure.

#### THE SERVICE DEPARTMENT



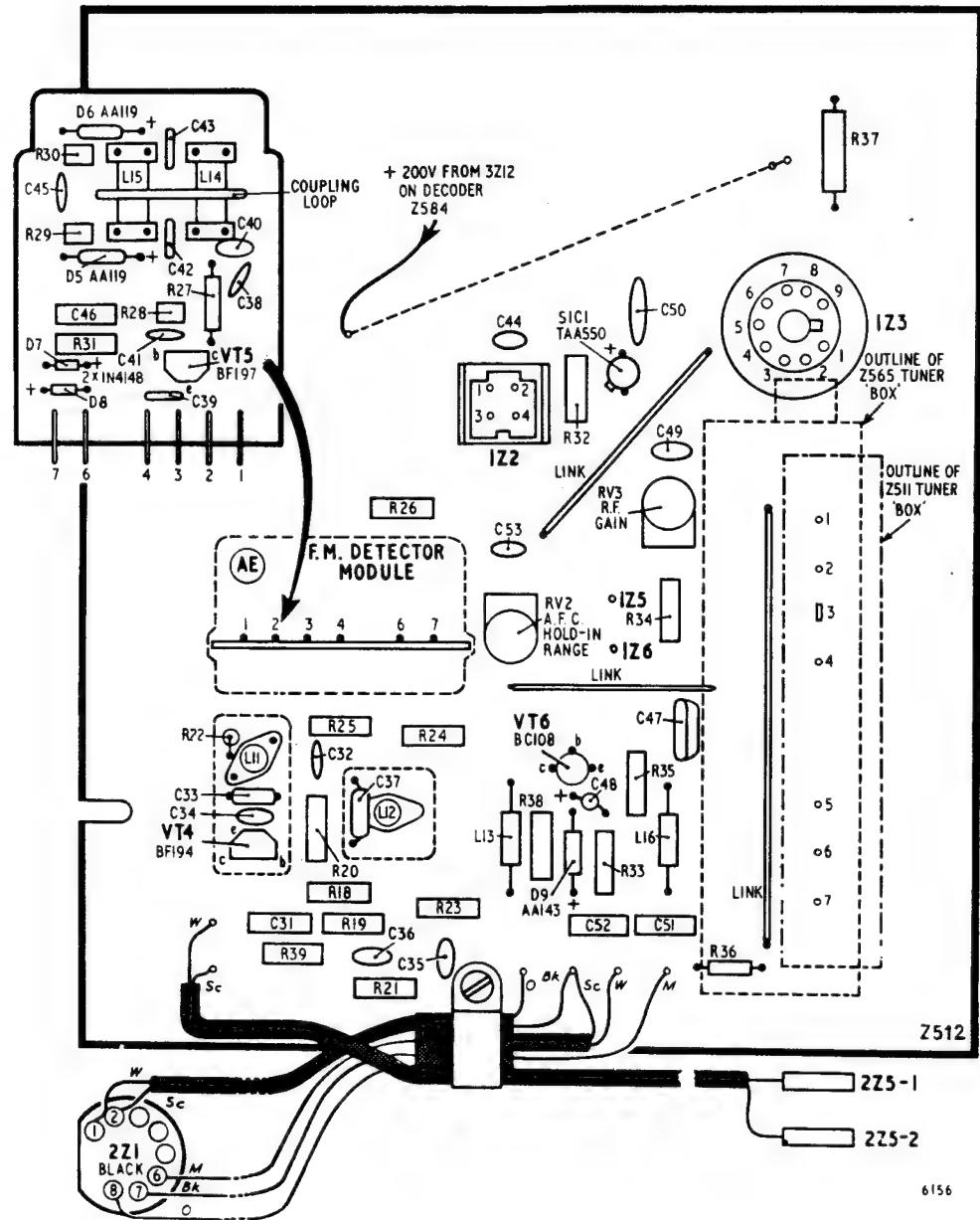
**RANK BUSH MURPHY**

A DIVISION OF THE RANK ORGANISATION

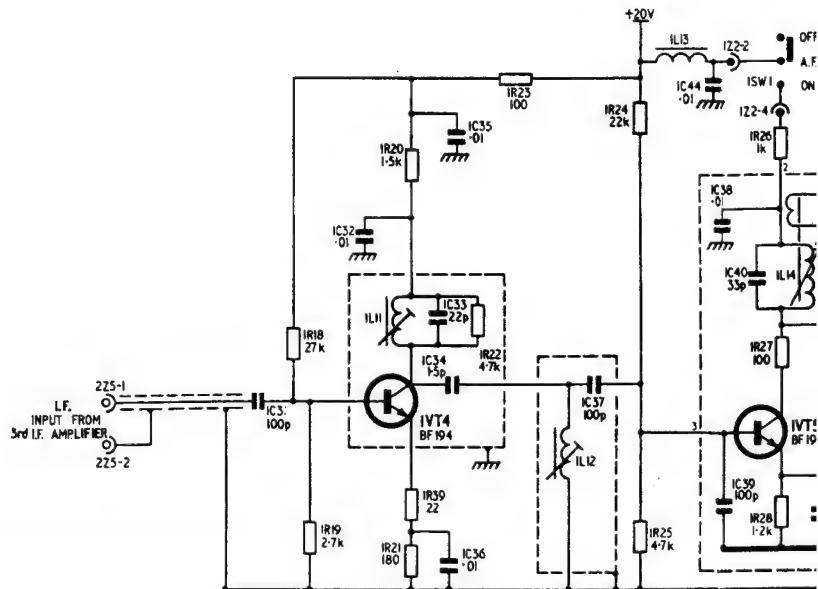
DRAYTON ROAD · BOREHAM WOOD · HERTFORDSHIRE · ENGLAND

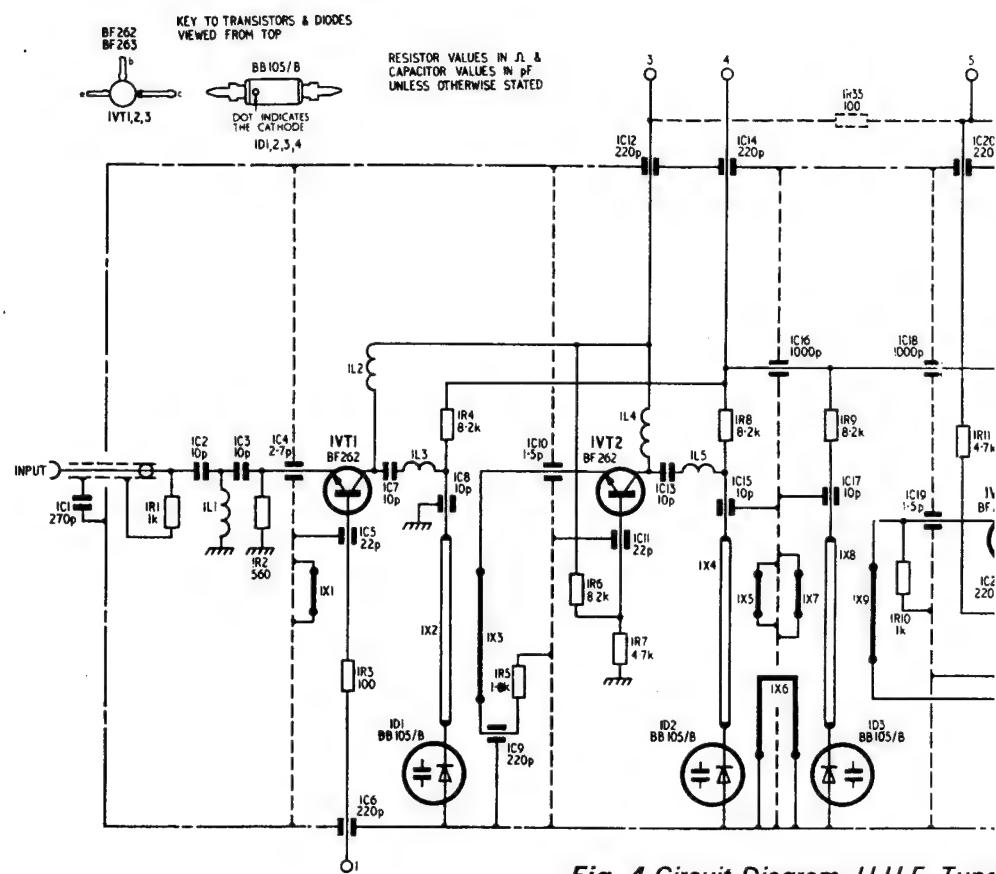
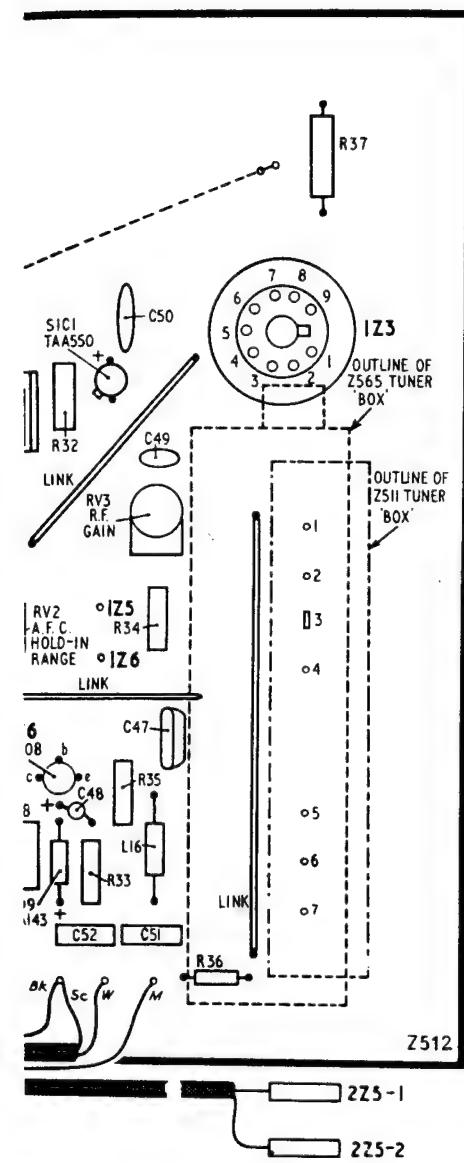
Telephone : 01-953 6151 · Telex : 262741 · Cables : Rankboom Boreham Wood

Issued by the Technical Publications Department at R.B.M. London W4.



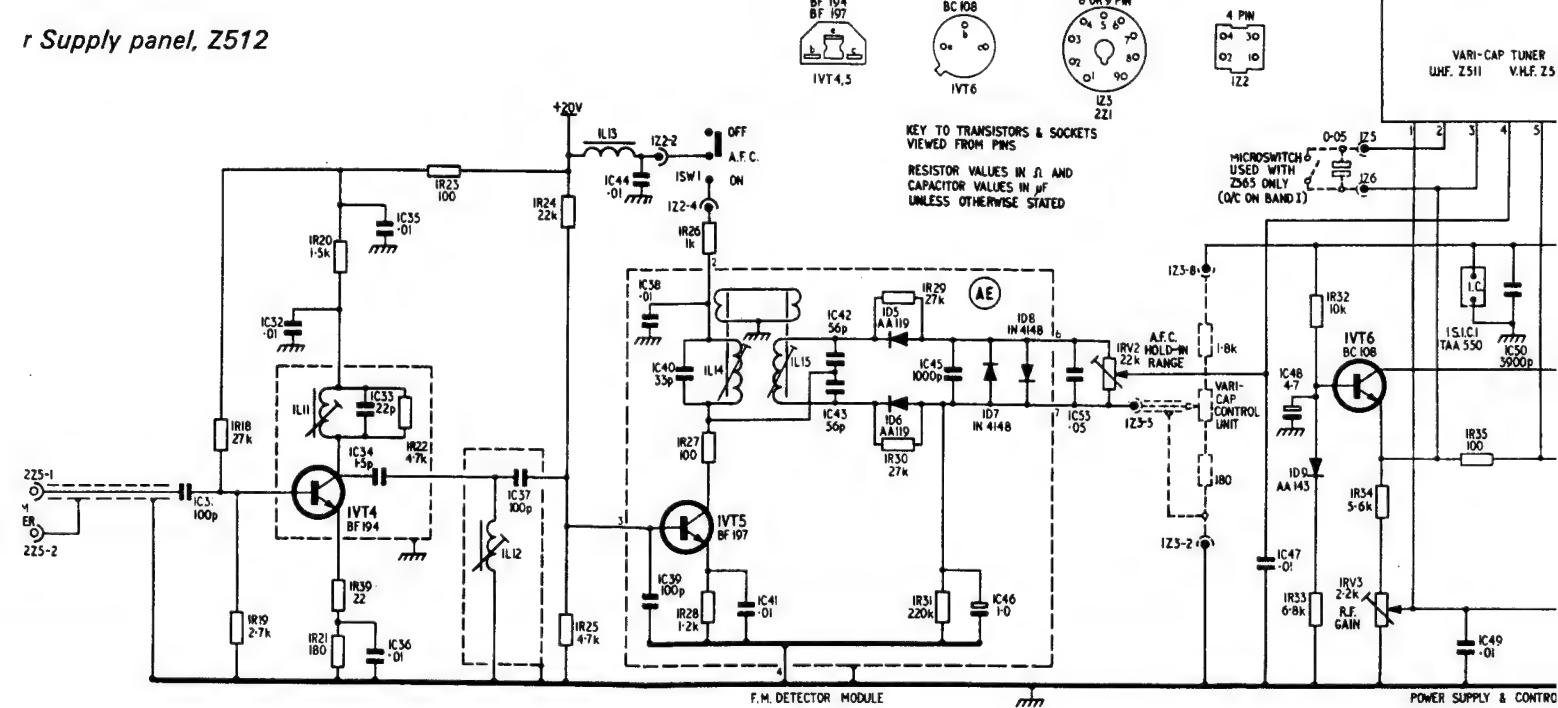
**Fig. 3 Component Layout, A.F.C. and Power Supply panel, Z512**





**Fig. 4 Circuit Diagram, U.H.F. Tuner**

Power Supply panel, Z512



**Fig. 5 Circuit Diagram, A.F.C. and Power Supply Panel**

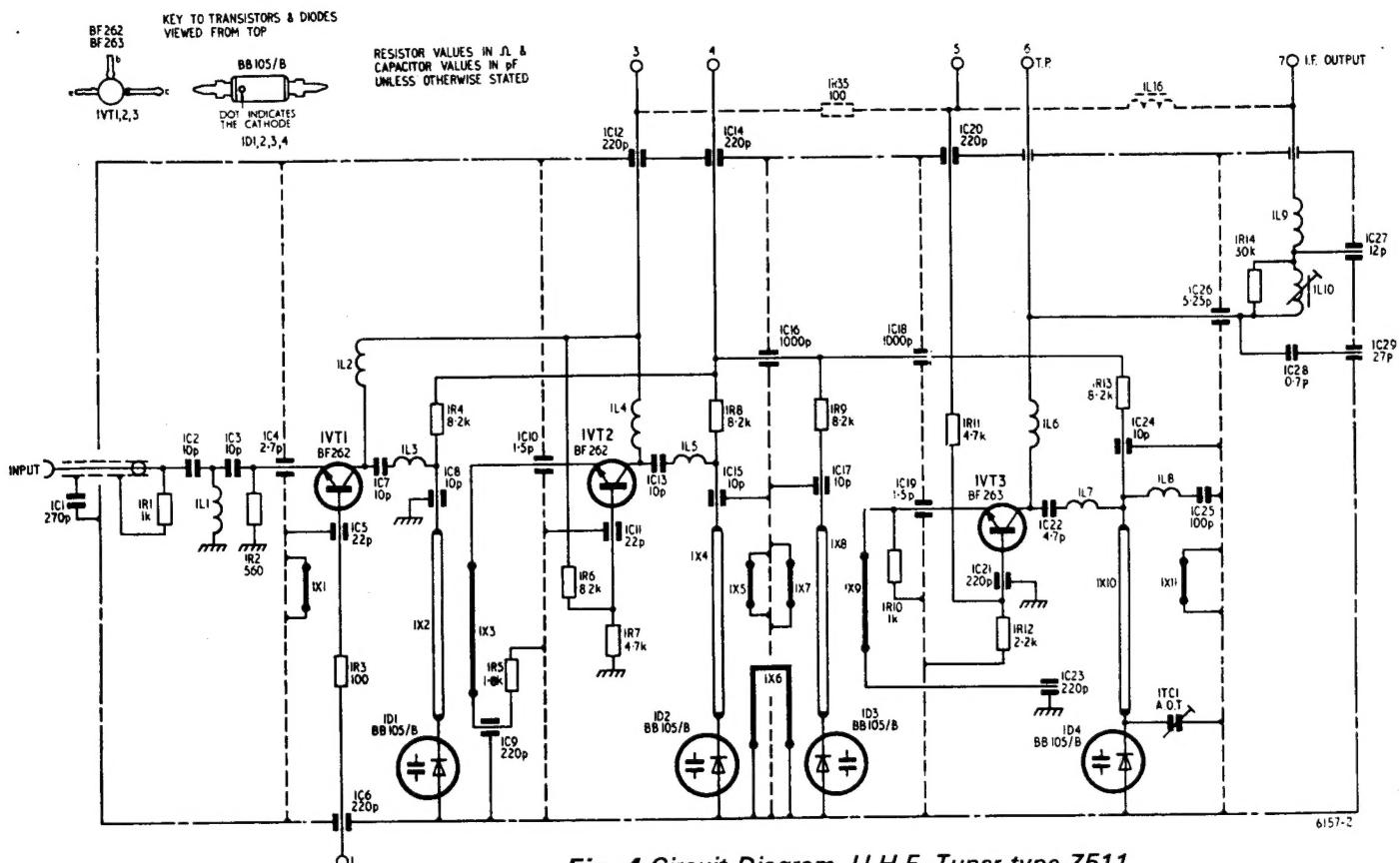
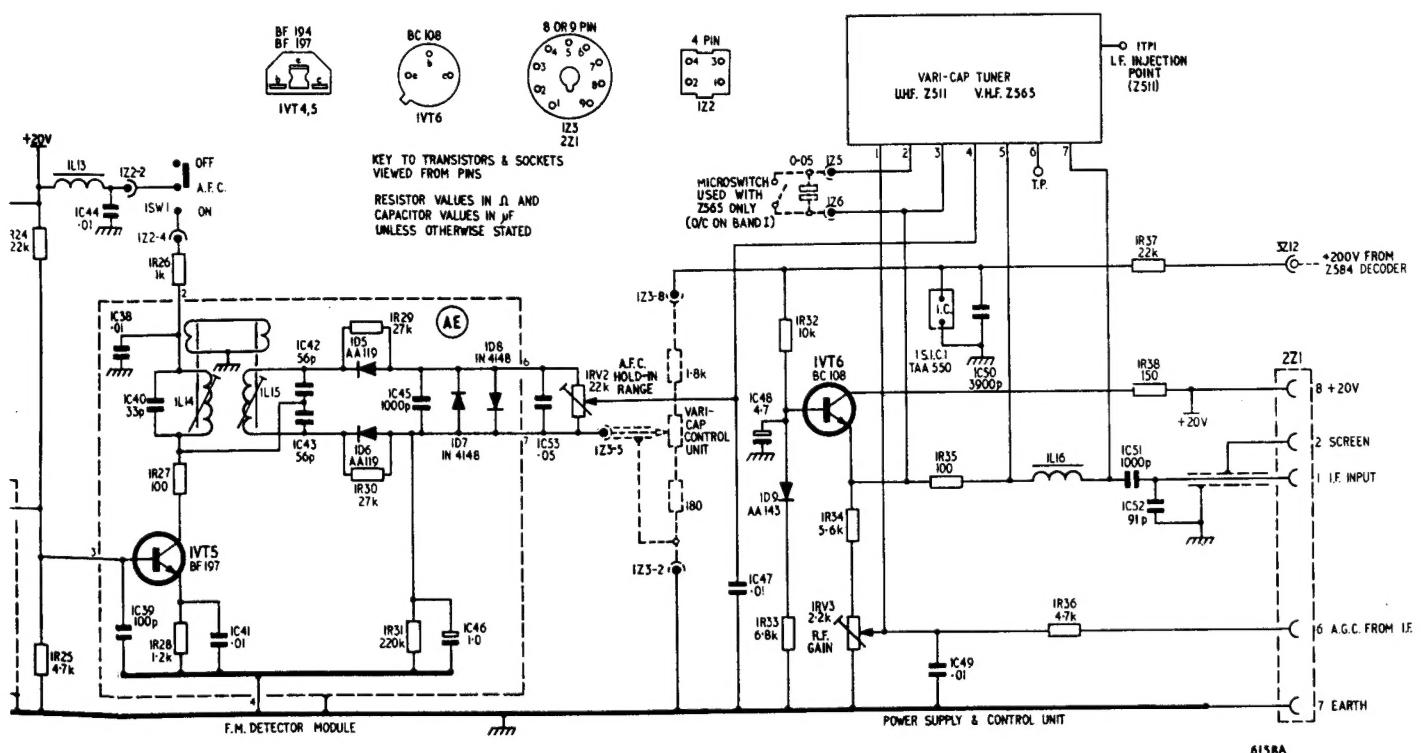


Fig. 4 Circuit Diagram, U.H.F. Tuner type Z511



# Electrical Parts, Z511 U.H.F. Tuner Unit

Note: As the parts contained within the varicap tuner units are set in position during manufacture, any repositioning will adversely affect the performance of the units. Dealers are strongly advised not to attempt to service these units.

## RESISTORS

Ref.	Value (ohms)	Tolerance (±%)	Rating (watts)	Part Number
1R1	1k	5	0.125	2052 1789
1R2	560	5	0.125	2052 1716
1R3	100	5	0.125	2052 1522
1R4	8.2k	5	0.125	2052 2022
1R5	1.8k	5	0.125	2052 1844
1R6	8.2k	5	0.125	2052 2022
1R7	4.7k	5	0.125	2052 1960
1R8	8.2k	5	0.125	2052 2022
1R9	8.2k	5	0.125	2052 2022
1R10	1k	5	0.125	2052 1789
1R11	4.7k	5	0.125	2052 1960
1R12	2.2k	5	0.125	2052 1868
1R13	8.2k	5	0.125	2052 2022
1R14	30k	5	0.125	2052 2162

## CAPACITORS

Ref.	Value (pF)	Tolerance (±%)	Rating (volts)	Part Number
1C1	270	+40 -20	3kV	2541 0167
1C2	10	20	3kV	2505 1301
1C3	10	±0.5p	40	2057 0067
1C4	2.7	±0.5p	250	2599 0068
1C5	22	10	250	2599 0056
1C6	220	10	500	2541 0313
1C7	10	±0.5pF	40	6882 0008
1C8	10	10	250	2599 0044
1C9	220	20	250	2599 0019
1C10	1.5	±0.5pF	250	2599 0081
1C11	22	10	250	2599 0056
1C12	220	10	500	2541 0313
1C13	10	±0.5pF	40	6882 0008
1C14	220	10	500	2541 0313
1C15	10	10	250	2599 0044
1C16	1000	+80 -20	300	2541 0210
1C17	10	10	250	2599 0044
1C18	1000	+80 -20	300	2541 0210
1C19	1.5	±0.5pF	250	2599 0081

## CAPACITORS—continued

Ref.	Value (pF)	Tolerance (±%)	Rating (volts)	Part Number
1C20	220	10	500	2541 0313
1C21	220	20	250	2599 0019
1C22	4.7	±0.5pF	40	6882 0021
1C23	220	20	250	2599 0019
1C24	10	10	250	2599 0044
1C25	100	20	250	2599 0093
1C26	5.25	±0.5pF	300	2541 0295
1C27	12	10	300	2541 0301
1C28	0.7	±0.25pF	500	2505 1349
1C29	27	10	500	2541 0337

## DIODES, VARICAP

Ref.	Type	Function	Part Number
1D1	BB105/B	Pre-selector tuning	3645 0029
1D2	BB105/B	Bandpass filter (primary) tuning	3645 0029
1D3	BB105/B	Bandpass filter (secondary) tuning	3645 0029
1D4	BB105/B	Oscillator tuning	3645 0029

## INDUCTORS

Ref.	Description	Part Number
1L1	Choke, high-pass filter	6811 0352
1L2	Choke	6811 0443
1L3	Choke/capacitor (1C7)	6882 0008
1L4	Choke	6811 0340
1L5	Choke/capacitor (1C13)	6882 0008
1L6	Choke	6811 0364
1L7	Choke/capacitor (1C22)	6882 0021
1L8	Choke, rejector	6811 0364
1L9	Choke	6811 0364
1L10	I.F. output coil	7100 4786

## TRANSISTORS

Ref.	Type	Function	Part Number
1VT1	BF262	R.F. amplifier	3632 0341
1VT2	BF262	R.F. amplifier	3632 0341
1VT3	BF263	Mixer/oscillator	3632 0328

# Z512

## A.F.C. and Power Supply Panel

### RESISTORS

Ref.	Value (ohms)	Tolerance (±%)	Rating (watts)	Part Number
1R18	27k	5	0.25	2055 5908
1R19	2.7k	5	0.25	2055 5647
1R20	1.5k	10	0.2	2001 0722
1R21	180	5	0.25	2055 5337
1R22	4.7k	10	0.125	2052 0797
1R23	100	5	0.25	2055 5271
1R24	22k	5	0.25	2055 5878
1R25	4.7k	5	0.25	2055 5702
1R26	1k	10	0.2	2001 0709
1R27	100	10	0.125	2052 0566
1R28	1.2k	10	0.3	2037 0702
1R29	27k	10	0.3	2037 0878
1R30	27k	10	0.3	2037 0878
1R31	220k	10	0.2	2001 1003
1R32	10k	10	0.2	2001 0837
1R33	6.8k	10	0.2	2001 0813
1R34	5.6k	10	0.2	2001 0801
1R35	100	10	0.2	2001 0564
1R36	4.7k	10	0.125	2052 0797
1R37	22k	5	0.25	2055 1113
1R38	150	10	0.2	2001 0588
1R39	22	5	0.25	2055 5088

### RESISTORS, VARIABLE

Ref.	Value (ohms)	Rating (watts)	Function	Part Number
1RV2	22k	0.2	A.F.C. hold-in range	2355 0053
1RV3	2.2k	0.2	R.F. gain	2355 0089

### CAPACITORS

Ref.	Value (μF)	Value (pF)	Tolerance (±%)	Rating (volts)	Part Number
1C31		100	10	500	2525 0486
1C32	0.01		+80 -20	50	2566 0019
1C33		22	2.5	125	2653 1306
1C34		1.5	10		2555 0007
1C35	0.01		+80 -20	50	2566 0019
1C36	0.01		+80 -20	50	2566 0019
1C37		100	2.5	125	2653 0284
1C38	0.01		+80 -20	50	2566 0019
1C39		100	2		2557 0195
1C40		33	5		2556 0207
1C41	0.01		+80 -20	50	2566 0019
1C42		56	2		2557 0158
1C43		56	2		2557 0158
1C44	0.01		+80 -20	50	2566 0019
1C45		1000	20		2561 0193

CAPACITORS					INTEGRATED CIRCUIT				
Rating	Part Number	Ref.	Value ( $\mu$ F)	Tolerance ( $\pm$ %)	Rating (volts)	Part Number	Ref.	Type	Function
500	2541 0313	1C46	1.0		2751 0402		1S1C1	TAA550	Varicap supply stabilizer
250	2599 0019	1C47	0.01	20	2601 0008				
40	6882 0021	1C48	4.7	20	2759 0173				
250	2599 0019	1C49	0.01	+80 -20	50	2566 0019			
250	2599 0044	1C50	3900	20	500	2563 0040			
250	2599 0093	1C51	1000	20	500	2535 0134			
300	2541 0295	1C52	91	5		2701 0636			
300	2541 0301	1C53	0.05	+80 -20	10	2566 0342			
500	2505 1349								
500	2541 0337								
<b>DIODES</b>									
		Ref.	Type	Function		Part Number			
		1D5	AA119	F.M. detector diodes		3641 0020			
		1D6	AA119			3641 0020			
		1D7	1N4148			3641 1601			
		1D8	1N4148	Clipping diodes.		3641 1601			
		1D9	AA143	Temperature compensation diode		3641 1607			
<b>INDUCTORS</b>									
		Ref.		Function					
		1L11		Bandpass coil (collector)					
		1L12		Bandpass coil (output)					
		1L13		R.F. choke					
		1L14		F.M. detector coil primary					
		1L15		F.M. detector coil secondary					
		1L16		Rejector coil					
<b>TRANSISTORS</b>									
		Ref.	Type	Function					
		1VT4	BF194	Narrow band i.f. amplifier					
		1VT5	BF197	F.M. detector driver					
		1VT6	BC108	Voltage regulator					

## Mechanical Parts

Part Number
3645 0029
3645 0029
3645 0029
3645 0029
3645 0029
3645 0029
Part Number
6811 0352
6811 0443
6882 0008
6811 0340
6882 0008
6811 0364
6882 0021
6811 0364
6811 0364
7100 4786

## MODIFICATIONS

on	Part Number
hold-in range in	2355 0053
in	2355 0089

Rating	Part Number
500	2525 0486
50	2566 0019
125	2653 1306
	2555 0007
50	2566 0019
50	2566 0019
125	2653 0284
50	2566 0019
	2557 0195
	2556 0207
50	2566 0019
	2557 0158
50	2566 0019
	2561 0193

**INTEGRATED CIRCUIT**

Ref.	Type	Function	Part Number
1S1C1	TAA550	Varicap supply stabilizer	3646 0175

**INDUCTORS**

Ref.	Function	Part Number
1L11	Bandpass coil (collector)	7100 4737
1L12	Bandpass coil (output)	7100 4749
1L13	R.F. choke	7100 1797
1L14	F.M. detector coil primary	7100 4713
1L15	F.M. detector coil secondary	7100 4725
1L16	Rejector coil	7100 0070

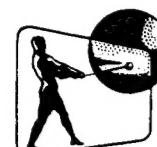
**TRANSISTORS**

Ref.	Type	Function	Part Number
1VT4	BF194	Narrow band i.f. amplifier	3632 0171
1VT5	BF197	F.M. detector driver	3632 0195
1VT6	BC108	Voltage regulator	3632 0201

**Part Number**

but less tuner	..	..	..	7500 4458
	..	..	..	7300 3815
	..	..	..	3439 0121
	..	..	..	3439 0066
	..	..	..	3242 0080
	..	..	..	3242 0134
	..	..	..	3242 0122
	..	..	..	3416 0139
	..	..	..	7200 1719
	..	..	..	3431 0642
	..	..	..	3431 0629
	..	..	..	3435 0019
ss contacts	..	..	..	3439 0145
	..	..	..	7300 3797
	..	..	..	7300 3943

**THE SERVICE DEPARTMENT**



**RANK BUSH**  
A COMPANY WITHIN

DRAYTON ROAD

BOREHAM WOOD

Telephone: 01-953 6151

Telex: 26274

Issued by the Technical Publications Depa